

KHB 5310.1  
Revision D  
August 2000

**Safety, Health and Independent Assessment**

**Reliability, Maintainability and Quality  
Assurance Handbook**

**Responsible Office:** QA/Director of Safety, Health & Independent  
Assessment

PREFACE

This Handbook applies to all John F. Kennedy Space Center (KSC) organizational elements, other NASA Center personnel temporarily assigned at KSC, and to contractors to the extent specified in their respective contracts.

The Handbook includes General Operating Policies (GOPs) covering the information required to conduct various aspects of the Reliability, Maintainability and Quality Assurance (RM&QA) Programs at KSC.

This Handbook supersedes KHB 5310.1C and all its changes dated July 25, 1991.

Shannon D. Bartell  
Director of Safety, Health &  
Independent Assessment

Tech Doc Library

TABLE OF CONTENTS

<u>SECTION</u>	<u>TITLE</u>	<u>PAGE</u>
1	INTRODUCTION	1-1
1.1	General	1-1
1.2	Scope	1-1
1.3	Applicability	1-2
1.4	Functions	1-2
1.5	Deviations and Waivers	1-3
2	MANAGEMENT	2-1
2.1	General	2-1
2.2	Development	2-1
GOP 2-1	Reliability Maintainability, and Quality Assurance Plans	2-2
GOP 2-1-1	Format	2-4
GOP 2-2	Contract Procurements with Reliability, Maintainability, and Quality Assurance Functions	2-6
GOP 2-3	Surveys and Audits	2-9
GOP 2-4	Deleted	
GOP 2-5	SRM&QA Personnel Training and Certification	2-21
3	DESIGN AND DEVELOPMENT	3-1
3.1	General	3-1
3.2	Documentation	3-1
GOP 3-1	Design Reviews	3-2
GOP 3-1-1	Reliability Checklist	3-5
GOP 3-1-2	Quality Checklist	3-7
GOP 3-2	Government-Industry Data Exchange Program (GIDEP) and KSC ALERT System	3-9
GOP 3-2-1	Examples of Problems for ALERTS and SAFE-ALERTS	3-20
GOP 3-3	KSC Maintainability Program	3-24
GOP 3-4	NASA Standard Parts Program	3-25
4	PROCUREMENT	4-1
4.1	General	4-1
4.2	Cycle	4-2
4.3	Documentation	4-2
4.4	Sources	4-2

TABLE OF CONTENTS (Continued)

<u>SECTION</u>	<u>TITLE</u>	<u>PAGE</u>
GOP 4-1	SRM&QA Requirements in Procurement Documents	4-3
GOP 4-1-1	Sample Requirements for Support Contracts	4-6
GOP 4-2	Preaward Surveys	4-15
GOP 4-3	To Be Assigned	
GOP 4-4	Deleted	
GOP 4-5	Delegation of Contract Administration Services	4-17
GOP 4-6	Quality Assurance Technical Representatives	4-19
GOP 4-7	Source Inspection	4-22
GOP 4-8	Receiving Inspection	4-23
GOP 4-9	Final Acceptance of KSC Procurements	4-26
5	FABRICATION	5-1
5.1	General	5-1
5.2	Inspection	5-1
GOP 5-1	Requests for Support	5-2
GOP 5-2	Fabrication Controls	5-5
GOP 5-3	KSC Space Shuttle Tool Control Program	5-8
GOP 5-4	KSC Foreign Object Control Program	5-11
6	INSPECTION AND TEST	6-1
6.1	General	6-1
6.2	Records	6-1
6.3	Personnel	6-1
GOP 6-1	Mandatory Inspections	6-2
GOP 6-2	Integrity Control	6-7
GOP 6-3	Inspection Planning	6-11
GOP 6-4	Quality Assurance Designees	6-15
GOP 6-5	Inspection/Test Performance and Records	6-18
GOP 6-6	Acceptance Data Packages	6-23

TABLE OF CONTENTS (Continued)

<u>SECTION</u>	<u>TITLE</u>	<u>PAGE</u>
7	NONCONFORMING ARTICLES AND MATERIALS GENERAL	7-1
7.1	General	7-1
7.2	Documentation	7-1
7.3	Personnel	7-1
GOP 7-1	Corrective Action at Offsite Locations	7-2
GOP 7-2	Nonconforming Items, Tagging of	7-3
GOP 7-3	Deviation/Waiver	7-5
GOP 7-4	Failure Analysis	7-8
GOP 7-4-1	Failure Analysis-Corrective Action Requests	7-10
GOP 7-5	Material Review Boards	7-11
8	METROLOGY/CALIBRATION	8-1
8.1	General	8-1
8.2	Calibration	8-1
GOP 8-1	Metrology/Calibration	8-2
9	QUALITY STATUS STAMPS	9-1
9.1	General	9-1
9.2	Controls	9-1
10.	HANDLING STORAGE, PRESERVATION, MARKING, LABELING, PACKAGING, PACKING, and SHIPPING	10-1
GOP 10-1	Handling, Storage, Preservation, Marking Labeling, Packaging, Packing, and Shipping	10-3
GOP 10-2	Age/Limited Life Controls	10-6

LIST OF REFERENCES AND APPLICABLE DOCUMENTS

**Note:** Use latest change/revision

GP-435, Engineering Drafting Practices Manual for Facilities

KDP-KSC-P-1535, Design Review Process

KHB 1200.1, Facilities, Systems, and Equipment Management  
Handbook

KHB 1710.2, Kennedy Space Center Safety Practices Handbook

KHB 3410.1, Implementing Instructions for KSC Systems, Safety and  
Skills Training, and for Certification of Personnel

KHB 4000.1, Supply Support System Manual

KMI 1420.1, KSC Forms Management Program

KPD 8710.1, KSC/Safety, Reliability, and Quality Assurance  
Programs

KSC-DE-512-SM, Guide for Design Engineering of GSE and Facilities  
for Use at KSC

KSC-DF-107, DE Technical Documentation File Guide

K-SM-12.6, Provisioning Plan

MIL-HDBK-338(1A), Electronic Reliability Design Handbook

MIL-HDBK-472, Maintainability Prediction

MIL-HDBK-695C, Rubber Products: Recommended Shelf Life

MIL-M-38510, Microcircuits, General Specifications for

MIL-STD-129, Marking for Shipment and Storage

LIST OF REFERENCES (Continued)

MIL-STD-883, Test Methods and Procedures for Microelectronics

MIL-STD-973, Configuration Management

MIL-STD-1472, Human Engineering Design Criteria for Military  
Systems, Equipment and Facilities

MIL-HDB-2165, Testability Handbook for System and Equipment

NASA-STD-3000, Man-System Integration Standards, Vol. I-IV

NASA TM 4628, Recommended Techniques for Effective  
Maintainability

NPG 5100.4, Federal Acquisition Regulation Supplement (NASA/FAR  
Supplement)

NPD 5101.32, Procurement

NPG 5300.4(2B-3), Management of Government Quality Assurance  
Functions for NASA Contracts

NPG 6000.1, Requirements for Packaging, Handling, and  
Transportation for Aeronautical and Space Systems,  
Equipment and Associated Components

NPD 8720.1, NASA Reliability and Maintainability(R&M) Program  
Policy

NPD 8730.2 NASA Parts Policy

NPD 8730.3 NASA Quality Management System Policy (ISO 9000)

NSTS 5300.4(1D-2) Safety, Reliability, Maintainability and  
Quality Provisions for the Space Shuttle  
Program

SSP 30223, Problem Reporting and Corrective Action  
for Space Station Programs

SSP 30234, Instructions for Preparation of Failure Modes and  
Effects Analysis and Critical Items List for Space  
Station

LIST OF REFERENCES (Continued)

- SSP 30309, Safety Analysis and Risk Assessment Requirement Document
- SSP 30312, Electrical, Electronic, and Electromechanical Parts Management and Implementation Plan for the Space Station Program
- SSP 30423, Space Station Approved Electrical, Electronic, and Electromechanical Parts List
- SSP 41173, Space Station Quality Assurance Requirements



## SECTION I: INTRODUCTION

### 1.1 GENERAL

This Handbook contains Reliability, Maintainability, and Quality Assurance (RM&QA) requirements to be implemented at the John F. Kennedy Space Center (KSC). These requirements are consistent with NASA RM&QA philosophies and practices and are designed to assure KSC meets institutional and programmatic RM&QA goals in a timely and cost effective manner. Strong emphasis is placed on satisfactory accomplishment of all functions having a significant bearing on RM&QA, beginning with the first phases of program initiation and continuing through program completion (i.e., from design through launch operations).

RM&QA plans shall be used to define performance requirements and management relationship within the RM&QA organizations. Where RM&QA functions are performed under a letter of delegation from another NASA installation, and a conflict occurs between this document and the letter of delegation, the letter of delegation shall prevail. The provisions of this Handbook shall not be included in KSC delegations to other government agencies.

The provisions of this Handbook shall be included in KSC contracts where deemed necessary by the contracting or source selecting officials. The RM&QA requirements shall be appropriately tailored. Consideration shall be given to the factors of criticality, complexity, state of the art, costs, and types of services or products requested. When deviations from this Handbook are required, they shall be identified in the appropriate RM&QA plans and procedures.

### 1.2 SCOPE

This Handbook sets forth the requirements for the reliability, maintainability, and quality assurance for those flight system, subsystem, components, Ground Support Equipment (GSE), and facilities systems essential to the KSC mission.

### 1.3 APPLICABILITY

This Handbook applies to all KSC organizations/contractors involved in the operation, maintenance, and servicing of flight system, subsystems, components, and in the acquisition, design, fabrication, and servicing of related GSE and facilities systems.

The RM&QA requirements for GSE and facilities systems under the cognizance of the Installation Operations Directorate or the Engineering Development Directorate in the design, fabrication, acquisition, construction, inspection, and test phases shall be governed by their respective directorate's RM&QA requirement specifications but as a minimum shall include the following RM&QA requirements:

- a. Review of specifications and design drawings.
- b. Review of RM&QA requirements for procurement requests of critical hardware and equipment in Categories 1, 1S and 1R.
- c. Concurrence of the Safety, Health and Independent Assessment Director shall be obtained by the originating directorate for procurements costing \$1,000,000 or more.
- d. Performing Ground Systems Safety and Reliability Analyses in accordance with KHB 1710.2. These documents provide the KSC ground rules for these analyses.

### 1.4 FUNCTIONS

This Handbook provides General Operating Policies (GOPs) for the RM&QA Program covering the following functions:

- a. Management
- b. Design and Development
- c. Procurement
- d. Fabrication
- e. Inspection and Test
- f. Nonconforming Articles and Materials

- g. Metrology/Calibration
- h. Handling, Storage, Preservation, Marking, Labeling,  
Packaging, Packing, and Shipping

#### 1.5 DEVIATIONS AND WAIVERS

Deviations and waivers from RM&QA requirements shall be in writing from the Director of Safety, Health and Independent Assessment in accordance with GOP 7-3.



## SECTION 2: MANAGEMENT

### 2.1 GENERAL

The Reliability, Maintainability, and Quality Assurance (RM&QA) programs are an integral part of KSC operations and, as such, are planned and developed in conjunction with Center activities to attain the following goals:

- a. Recognize RM&QA aspects of all KSC programs and provide an organized approach to achieve them.
- b. Ensure RM&QA requirements are implemented and completed throughout all program phases of design, development, processing, assembly, test and checkout, prelaunch, launch, and postlaunch activities.
- c. Provide for the detection, documentation, and analysis of actual and potential discrepancies, system(s) incompatibility, marginal reliability and quality, and trends that may result in unsatisfactory conditions.

### 2.2 DEVELOPMENT

The Director of Safety, Health and Independent Assessment develops RM&QA requirements to be implemented by Center directorates and contractors. Contractors shall implement specified RM&QA requirements in accordance with their contracts. Implementing details shall be provided in KSC and contractor RM&QA organization plans and internal procedures.

The Safety, Health and Independent Assessment Director shall assure the necessary reliability analyses, quality engineering studies, trend analyses, and other analytical services as hazard failure analyses, etc., are coordinated to assure the RM&QA program attains desired goals. RM&QA survey and audit activities measure program effectiveness, and periodic status reports prepared by the Safety, Health and Independent Assessment Directorate and contractor organizations provide a measure of program achievements.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 2-1**

**SUBJECT: RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
PLANS**

1. PURPOSE

The purpose of this policy is to establish basic requirements for the development, content, review, approval, and implementation of organizational Reliability, Maintainability, and Quality Assurance, (RM&QA) plans.

2. APPLICABILITY

This policy applies to all KSC organizations having RM&QA functions.

3. GENERAL PROVISIONS

- a. Organizational RM&QA plans shall describe, in detail, how the following requirements are to be implemented:
  - (1) The requirements contained in KPD 8710.1, "KSC/Safety, Reliability, and Quality Assurance Programs."
  - (2) KSC Management Instructions (KMIs) and Handbooks (KHBs) and General Operating Policies (GOPs).
  - (3) Delegated RM&QA functions (applicable requirements), contained in letters of delegation and NPG 5300.4(2B-3).
  - (4) R&QA organizational functional statements.
- b. RM&QA plans prepared by Safety, Reliability, Maintainability and Quality Assurance organizations shall address each of the applicable requirements contained in paragraph 3a and their place as an integral part of the overall directorate's function. Specific requirements contained in paragraph 3a shall be addressed from the viewpoint of how they will be implemented, who will implement them, when they will be implemented, and controls provided for their accomplishment.

- c. Plans shall contain a reference to all implementing procedures either in the appropriate paragraphs of the plans or as a separate addendum to the plans. Each requirement cited in the plans shall reference implementing procedures, or appropriate sections of the plans shall be sufficiently detailed to allow adequate implementation of requirements without procedures. The references to implementing procedures and the procedures shall be sufficiently detailed to provide traceability of the plan's requirements back to document(s) contained in paragraph 3a.
- d. RM&QA plans shall provide sufficient detail to permit evaluation of the adequacy of coverage and performance and degree of control being exercised over the RM&QA programs.
- e. RM&QA plans, and subsequent revisions shall be coordinated with the Safety, Health and Independent Assessment (SH&IA) Director for review prior to operating-directorate approval.
- f. Copies of all procedures initiated to implement reliability, maintainability, and quality assurance plans shall be provided to the SH&IA Director for review prior to issuance.
- g. Organizational plans will be prepared in accordance with GOP 2-1-1. Where a Section of format does not apply to an organization, "No Applicable Functions," will be entered under that paragraph number and title.
- h. Provisions for fulfilling all requirements of this issuance shall be included in the RM&QA plans or in procedures referenced in the RM&QA plans.
- i. RM&QA plans shall provide for maintaining objective evidence of RM&QA activities performed. Government Reliability, Maintainability, and Quality Assurance organizations except where contractor records contain evidence shall maintain appropriate records.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 2-1-1**

**SUBJECT: RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
PLANS FORMAT**

1. APPROVAL PAGE

- a. Date of Document
- b. Prepared By: Name and Organization of Preparer
- c. Approval: Signature of the Safety, Health and  
Independent Assessment Director for RM&QA plans.  
Signature of the Contracting Officer for Contractor  
Plans

2. LIST OF EFFECTIVE PAGES

This page shall provide a record of changes made to the plan and will include change number, date of change, and parts of plan changed.

3. TABLE OF CONTENTS

4. REFERENCES

All documents citing requirements to be fulfilled by the plan shall be listed, including NASA and KSC management issuance's, program project directives, and letters of delegation from other Centers.

5. INTRODUCTION

This section will contain an introduction to the plan, including purpose, scope and applicability, and special notations pertaining to additions, deletions, or changes in provisions cited in referenced documents.

6. ORGANIZATION

This section will identify organizational structure, assigned functions, and will include chart(s) of quality, reliability, and/or maintainability organization(s) showing relationship of organization(s) with respect to management. Details of this chart, or a separate chart, if desired, should show specific segments of quality and/or reliability organizations, functions



and responsibilities, and indicate participation in other functions; for example, engineering, procurement, and/or testing.

7. RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
FUNCTIONS

This section shall contain a description of all RM&QA functions for which the organization is responsible and shall be in narrative form with numbered paragraphs. GOP 2-1 (paragraph 3) shall be followed in defining tasks, referencing requirements documents, and referencing organizational implementing procedures.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 2-2**

**SUBJECT: CONTRACT PROCUREMENTS WITH RELIABILITY,  
MAINTAINABILITY, AND QUALITY ASSURANCE FUNCTIONS**

1. PURPOSE

This policy establishes requirements for the content of RM&QA plans, and establishes procedures for the submission, review, and approval of such plans when required by a KSC contract.

2. APPLICABILITY

This policy applies to all KSC organizational elements.

3. GENERAL PROVISIONS

- a. KSC procurements shall include RM&QA and inspection system provisions.
- b. Offeror's shall be required to submit summary (prior to award) and detailed (after award) programs and inspection system plans for software as well as hardware/services as specified in paragraph 3c based on criticality, complexity, and cost of hardware/services being procured. If the procurement request requires detailed RM&QA programs or inspection system plans, a preliminary quality assurance plan outlining the offeror's proposed quality assurance program shall be prepared and submitted with its proposal. Detailed quality program plans for major construction contractors shall be submitted for approval within 30 calendar days after receipt of notice to proceed.
- c. Detailed RM&QA plans, as applicable, shall:
  - (1) Be prepared in a format that readily identifies plan requirements to RM&QA statement of work requirements, the RM&QA specification.
  - (2) Serve as master planning and control document for contractor(s) RM&QA and inspection programs.
  - (3) Include charts and narrative descriptions of each element of contractor's organization (e.g., procurement, engineering, and reliability,

fabrication, test, safety, and quality assurance program) and detailed statements of duties, responsibilities, and functions relating to each task. The plan shall show the relationship between these organizational elements and individuals responsible for managing RM&QA program tasks and having authority to monitor and control cited tasks.

- (4) Describe the offeror's performance and management of each task. These shall be described in terms of when, by which organizations, and by which methods each task will be accomplished. Existing contractor policies and procedures and required new policies and procedures shall be referenced in the plan, either within the text or as an appendix showing cross references to tasks. All RM&QA plans and procedures shall be submitted as specified in the Data Requirements List/Data Requirement Description (DRL/DRD).
- (5) Include charts indicating flow of fabrication and assembly and related inspection and test points.
- d. Organizational elements responsible for review and approval of contractor plans shall use the foregoing criteria as a basis for determining acceptability of RM&QA and inspection system plans submitted by contractors.
- e. Authority to review and approve plans may be included in delegation of RM&QA functions to another Government agency when the procurement is estimated to cost less than \$1,000,000, and there is reasonable assurance that RM&QA requirements of critical hardware will not be compromised as a result of this delegation.
- f. Safety, Health and Independent Assessment Directorate recommends to the CMR and contracting officer approval/disapproval with comments to the contractor's plans.
- g. Revisions to plans shall be processed in the same manner as original submissions.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 2-3**

**SUBJECT: SURVEYS AND AUDITS**

1. PURPOSE

This policy establishes requirements, procedures, and responsibilities for conducting Safety, Reliability, Maintainability and Quality Assurance (SRM&QA) surveys and audits.

2. APPLICABILITY

This policy covers all SRM&QA activities under the cognizance of KSC and applies to all KSC organizational elements.

3. DEFINITIONS

- a. Government Agency: A contract administration office, such as, Air Force, Navy, or Defense Contract Management Command that has been delegated authority by KSC, or any element of KSC, to perform contract administration services functions.
- b. Audit: A systematic, independent, official, examination and verification of: records and other objective evidence of work performed; the process; or the process requirements to determine compliance to requirements; and to assess the effectiveness of implementation and identify potential improvements.
- c. Random Audit of Work Procedures: An unscheduled examination and review to determine the availability, use, and adequacy of work procedures used during operational tasks performed at KSC.
- d. Survey: An independent, official, comprehensive evaluation, and assessment of capabilities to ensure programmatic systems are adequately documented, effectively implemented, and suitable for achieving requirements and desired SRM&QA objectives.
- e. Work Procedures: Approved written instructions for performing assigned tasks; for example, assembly, test, test preparation, checkout, operation, and maintenance.

- f. Finding: Documented results of investigations and evaluations, which are based on substantiating evidence. A Finding may be:
  - (1) A "Nonconformance" identifying a deviation from requirements.
  - (2) An "Observation" identifying a condition or practice that should be corrected to improve a process.
  - (3) A "Verification" indicating compliance to a requirement.
  - (4) A "Commendation" recognizing outstanding performance.
- g. Primary Organizations: All organizations reporting to the Center Director.
- h. Scheduled Surveys and Audits: Surveys or audits performed on a predetermined basis.
- i. Unscheduled Surveys and Audits: Surveys or audits performed on a random basis or as a result of an identified problem area or valid request.
- j. Entrance Briefing: The first interview, usually held the first day of the survey/audit, attended by survey/audit team members and by management members of the organization to be reviewed to discuss the objectives and conduct of the survey/audit, brief team members, introduce personnel, and resolve any questions.
- k. Informal Debriefing: A meeting at the end of the survey/audit between the survey/audit team and the appropriate personnel of the reviewed organization to discuss the survey/audit results.
- l. Formal Debriefing: A critique conducted by the survey/audit team members to the surveyed organization's top management personnel and to the SH&IA Director. The debriefing is a survey option and is conducted only when requested by the reviewed organization or SH&IA as a result of controversial or significant Findings and Observations that could not be agreed on in the informal debriefing.

- m. Survey Audit Notice: A formal letter notifying the organization to be reviewed of the survey/audit dates, activities, or subjects upon which emphasis will be placed, the name of the survey/audit chairperson and any special requirements or requests, such as, work area documentation representation, and presentation.
- n. SRM&QA Random or Special Audit: A documented scheduled or unscheduled examination and review conducted of personnel, procedures, or operations which implement reliability, maintainability, or quality assurance requirements. Random audits may involve KSC work procedures.

4. GENERAL PROVISIONS

- a. The Safety, Health and Independent Assessment Directorate shall perform formal SRM&QA surveys, compliance audits, and process audits on complete programs, segments, or any phase or activity concerning SRM&QA. Surveys or audits may include any of the product or service requirements that affect the SRM&QA Program.
- b. When KSC has delegated SRM&QA oversight functions to another Government agency, surveys or audits of the reviewed contractor's activities shall be conducted through or by the agency.
- c. When an SRM&QA survey/audit is to be performed by a Government agency for KSC, the agency's survey/audit procedures shall be submitted to KSC SH&IA Director through the contracting officer for approval by SH&IA prior to implementation of the survey/audit.
- d. Normally, SRM&QA surveys or audits shall be scheduled, and organizations scheduled to be reviewed shall be officially notified at least one month in advance by an SH&IA Survey or Audit Notice Letter; however, unscheduled surveys or audits may be performed at any time. Surveys or audits are usually conducted on a noninterference basis. The SH&IA Director's organization shall prepare, approximately one month before the end of each calendar quarter, a schedule of surveys or audits planned for the next two successive quarters. Contractors and Government agencies shall be notified, through the contract management channels of the

cognizant primary organization, prior to the conduct of SH&IA surveys or audits.

- e. Surveillance of offsite KSC hardware contractors and Government agencies delegated KSC quality assurance tasks shall be performed by KSC.
- f. Heads of primary organizations who have contractors within their purview performing SRM&QA functions may request specific or special surveys or audits of their respective contractors.
- g. SH&IA personnel performing unscheduled audits shall comply with all security and safety regulations that apply to the subject and area of the audit. Audits shall not be conducted in a manner, which could interfere with a scheduled test or with individuals supporting or conducting the test.
- h. Laboratories engaged in research and development work are excluded from SH&IA random audits. However, if the laboratories are used to process (fabricate, clean, calibrate, adjust, etc.) equipment which is to become part of an operational system, then in-process procedures shall be required and shall be subject to audits.
- i. SH&IA conducts random audits of work procedures and periodically performs Safety, R&QA, and special audits to assess and evaluate the performance of Government and contractor personnel in meeting safety or operational requirements.
- j. SH&IA random audits of work procedures shall include:
  - (1) Existence of a work authorization.
  - (2) Existence and use of a work procedure at the site where work is being performed.
  - (3) Approval signatures and dates.
  - (4) Inclusion of adequate details and information for performing the work.
  - (5) Accomplishment of the work in accordance with the work procedure and acceptable work practices.

NOTE:

Safety, Health and Independent Assessment random audits do not relieve managers and supervisors, at all organizational levels, of their responsibilities for ensuring that adequate operating procedures are prepared, available, and followed during work operations.

- k. Findings considered significant, by personnel conducting surveys or audits, shall be identified (in real time) to the appropriate Government and contractor personnel if prompt corrective action is required.
- l. Heads of primary organizations are responsible for ensuring that:
  - (1) All levels of management under their jurisdiction are notified of the provisions of this procedure.
  - (2) Assistance is provided to the SH&IA Director surveying or auditing Government organizations, contractors, and Government agencies under their jurisdiction.
  - (3) A formal debriefing is requested (as required) following SH&IA survey/audits.
  - (4) Prompt and effective corrective action is taken on deficiencies noted in SH&IA survey/audit reports. Immediate action will be taken on findings that may result in loss of life, personnel injury, loss of mission, or damage to equipment.

Generally, survey/audit closure to nonconformances and observations is achieved after receipt of an acceptable Corrective Action Plan. Once the Corrective Action Plan is approved by SH&IA, any findings not completed will be subject to further review and appropriate action.
- (5) Contractors under their jurisdiction shall:
  - (a) Audit performance of in-house SRM&QA activities as required by the contract and approved in SRM&QA plans.



- (b) Audit performance of subcontractors and suppliers as required by the contract and approved in SRM&QA plans.
  - (c) Deliver audit schedules and reports to the Chief, Assessments Division, as requested.
- (6) Government agencies (including NASA resident personnel) survey and audit SRM&QA activities performed by the contractor or supplier as directed by the KSC letter of delegation.
- m. The chief of the audit organization, is responsible for ensuring that:
  - (1) KSC organizations, onsite Government agencies and onsite contractors having SRM&QA functions are periodically surveyed or audited.
  - (2) A six month schedule of planned surveys and audits is provided to the cognizant program management personnel approximately one month prior to the beginning of each quarter.
  - (3) Special activity areas that are included in surveys/audits are identified.
  - (4) Approximately one month in advance of the planned survey or audit, an approved letter of notification is distributed to the organization to be reviewed.
  - (5) Scheduled surveys and audits consist of an Entrance Briefing, an Informal Debriefing, and a Formal Debriefing (if requested). The SH&IA Director will be briefed on request by the survey/audit team during the report approval process.
  - (6) Random audits of procedures and SRM&QA requirements are performed in accordance with this procedure.
  - (7) Individuals are designated to perform random audits.
  - (8) The designated random auditors are provided with identification signed by the SH&IA Director.

- (9) Survey and audit findings are reported as Nonconformances, Observations, Verifications, and Commendations as described in paragraph 6.
- n. The chief of the procurement quality assurance organization is responsible for ensuring that:
  - (1) Offsite hardware contractors and associated Government agencies (including NASA resident R&QA personnel) under KSC cognizance are surveyed/audited in accordance with this procedure. Contractors and Government agencies having cognizance over these contractors having contracts lasting one year or more shall be surveyed/audited at least once each year.
  - (2) Special activity areas identified by NASA management are included in surveys/audits of offsite contractors and Government agencies.
  - (3) A 6 month schedule of planned surveys/audits is provided to the chief of the audit organization and appropriate cognizant program management personnel approximately 1 month prior to the beginning of each quarter.
  - (4) This procedure is incorporated into all stage, element, and support services and appropriate construction contracts extending for periods of one or more years.

5. SURVEY AND AUDIT REPORT FORMAT AND FOLLOWUP ACTIONS

a. SH&IA Survey and Audit Report Form

SH&IA survey and audit reports shall generally contain the following information in the format described below:

- (1) A transmittal letter signed by the SH&IA Director shall transmit the survey or audit report to the organization(s) reviewed.
- (2) Cover or Title

Page includes organization surveyed or audited, contract number and survey or audit dates.

(3) Approval Signature Page

(4) Executive Summary (Section 1.0)

Provides a brief overview of the entire survey or audit. Summarizes the findings of the entire report, highlighting the major findings that require management attention and their support to facilitate corrective action.

(5) Description and Organization of Survey or Audit (Section 2.0)

Includes purpose of the survey and audit, scope, names of survey and audit team members, and the survey and audit schedule.

(6) Survey or Audit Results and Recommendations (Section 3.0)

Survey or audit results are documented on KSC Form 2-96, Survey Record Sheet. A separate heading for each major activity area covered by the survey and audit shall be used. A narrative discussion of the pertinent facts examined or revealed, citation of requirements, descriptions of findings, when appropriate, and a recommendation of corrective action for each nonconformance shall be included. Observations shall include the rationale for the condition associated and the recommendation for improvement. Verifications and Commendations are also documented on KSC Form 2-96.

(7) Appendix

Include supplementary data, such as, charts, graphs, and hardware description, when pertinent.

b. Random Audit Reports

Results of random audits performed by the SH&IA organization shall be reported on KSC Form 2-97 (Work Procedures) or 2-97A (Special Audits), as appropriate. The reports that contain nonconformances are normally distributed within 10 workdays after performance of the audit. The audited organization is requested to report within 30 days what action is being taken to correct

the recorded audited nonconformance. The audit report is closed when the audited organization reports that corrective action has been taken.

c. Control and Distribution of Reports

- (1) Survey or audit reports of organizations and contractors shall not be distributed or forwarded outside KSC until the initial corrective action has been approved, except as specifically required to fulfill the intent of paragraph 5c(2)(c) or paragraphs 5c(3)(b) and (c).
- (2) When onsite surveys or audits are performed:
  - (a) The report shall usually be distributed at KSC within 15 working days after the Informal Debriefing, and not more than 30 working days after completion of the Informal or Formal Debriefing.
  - (b) The survey or audit report shall be forwarded to the head of the cognizant KSC primary organization, with an information copy to the cognizant Program and Project Directors and Managers.
  - (c) The heads of the primary organizations receiving the survey or audit report shall:
    1. Reply by letter to the SH&IA Director if the survey or audit covers a KSC organization. Attach the reply letter to a copy of the report.
    2. Obtain reply through appropriate contract management channels, if the survey or audit report covers an agency or contractor. Attach the reply to a copy of the report and forwarded to the SH&IA Director.
    3. Retain and distribute copies of the survey or audit report as indicated in the letter of transmittal from the SH&IA Director.

- (3) When offsite surveys are performed:
  - (a) The survey/audit report of an agency shall be directed to the agency, with copies to the designated contracting officer.
  - (b) The survey/audit report of a contractor (when there is no agency) shall be directed to the designated contracting officer.
  - (c) Request for corrective action shall be directed to the designated contracting officer.
  - (d) Information copies of all reports shall be forwarded to the SH&IA Director and the designated program and project director and manager, with distribution to other organizations as applicable.

d. Follow-up Actions

- (1) Surveyed or audited organizations shall be required to:
  - (a) Reply to the report as directed by the Letter(s) of Transmittal from the SH&IA Directorate. Provide a corrective action plan stating the actions to be taken and their scheduled completion dates. The survey or audit may be closed upon approval and acceptance of the Corrective Action Plan.
  - (b) Take prompt action to effectively closeout all nonconformances and observations in accordance with the schedule in the approved Corrective Action Plan.
  - (c) Fully explain any noncompliance with report recommendations and if alternative solutions are used indicate rationale why they are preferred.
  - (d) Request modifications to the schedule contained in the corrective action plan.
- (2) Surveying or auditing organizations shall:

- (a) Approve or disapprove the Corrective Action Plan, in writing, to replying organization; normally, within 30 working days after receipt.
  - (b) Sample scheduled closeout actions.
  - (c) Approve or disapprove requested schedule modifications or extensions.
  - (d) Maintain official files of survey and audit reports, Corrective Action Plans, and sampling results of closeout actions.
- (3) Copies of all replies and approval or disapproval correspondence shall be distributed in same manner as related report.
  - (4) Follow-up investigations shall be reported and processed in same manner as the original survey or audit.

6. REPORTING TO CENTER UPPER MANAGEMENT

The SH&IA Director will, when deemed appropriate:

- a. Forward survey or audit reports containing significant discrepancies, with all replies and approvals or disapprovals, to the Center Director for review.
- b. Forward reports of random audits containing significant nonconformances to the head of the appropriate primary organization and, when considered necessary, to the Center Director for review.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 2-5**

**SUBJECT: SRM&QA PERSONNEL TRAINING AND CERTIFICATION**

1. PURPOSE

The purpose of this policy is to establish the training and certification requirements for Safety, Reliability, Maintainability, and Quality Assurance (SRM&QA) personnel.

2. APPLICABILITY

This policy applies to all KSC organizational elements having SRM&QA functions and to their associated contractors having SRM&QA functions to the extent specified in their respective contracts.

3. DEFINITIONS

- a. Certification: The act of providing documentation an individual has met all training and examination requirements to perform a specific function, skill, or operation.
- b. Qualification: The act of recording completion of all training, experience, and testing required to qualify someone to perform a specific function, skill, or operation.
- c. Critical Tasks: All tasks satisfy one or more of the following criteria are to be designated as critical and require personnel training and certification to be so designated.
  - (1) Law, Government agencies, contract, or specification requires it.
  - (2) Affects personnel safety or NASA mission accomplishment.
  - (3) Safety of a worker or his/her associates depends upon his/her ability.
  - (4) The critical nature of the work or process requires demonstrated ability on the part of the worker

and/or inspector to assure quality and reliability of the product.

- (5) Failure to successfully complete the work in progress would cause serious or costly damage to the product or facilities.
- (6) The complexity of the work, or the skill/knowledge required to perform the work, makes it difficult to assess work proficiency or compliance with applicable specifications.

d. Formal Training: Contractor certification training is normally accomplished as a formal program with end-of-course testing/proficiency demonstration. Two exceptions to this requirement are when:

- (1) Training and operational proficiency can be accomplished on the job without hazard to personnel or equipment.
- (2) The nature of the task does not permit training in a formal classroom environment.

#### 4. GENERAL PROVISIONS

- a. All civil service SRM&QA personnel performing critical tasks or controlling special/critical processes, or potentially hazardous operations in manufacturing fabrications, modifications, tests, checkout, maintenance, inspection, and operations shall be trained and qualified, but not certified, to accomplish the specified tasks. All contractor personnel will be trained and qualified, and specifically designated personnel certified to accomplish these tasks.
- b. Each SRM&QA position shall be reviewed, and where appropriate, training and certification requirements shall be established.
- c. Training of SRM&QA personnel shall consist of formal and/or on-the-job training, and shall include controls which shall indicate for each individual, as a minimum, all required and completed courses. Consideration shall be given to previous training and experience in lieu of further training on an individual basis.



- d. Upon completion of the required training, and demonstration of knowledge and/or proficiency, the employee shall be certified (as applicable) and shall be issued a certification card by the head of the appropriate organization for assignment in the area covered by the training. SRM&QA personnel shall be certified, as required, by the heads of the highest level organizational element, which perform RM&QA functions. Those personnel certified to perform critical tasks shall have their certification cards available when performing critical tasks to verify their certification for accomplishing these tasks.
- e. Details of the training and certification program shall be included in the contractor's SRM&QA operating plans or procedures, including the method used to provide employees with evidence of valid certifications when periodic recertification is required. The training, plans shall be approved as an integral part of the contractor's SRM&QA plan approval.
- f. Survey/audit personnel shall be trained and qualified to conduct surveys/audits in accordance with organizational standards.



### SECTION 3: DESIGN AND DEVELOPMENT

#### 3.1 GENERAL

The Reliability, Maintainability and Quality Assurance (RM&QA) program provides for participation, by RM&QA personnel, in all phases of the design and development process. This effort shall include reviews and assessments of: human factors, design, hazard analyses, failure mode and effect analyses, test plans and procedures. RM&QA involvement in design and development processing shall encompass element contractor activities having an impact on operations and design.

#### 3.2 DOCUMENTATION

RM&QA personnel shall review technical documents, changes, and revisions having an effect on reliability, maintainability and quality assurance. These reviews shall be an integral part of RM&QA functions to ensure timely planning of inspection, test and checkout, launch, post flight inspection, and refurbishing activities.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 3-1**

**SUBJECT: DESIGN REVIEWS**

1. PURPOSE

This policy provides for Reliability, Maintainability and Quality Assurance (RM&QA) participation in design reviews. In addition, guidelines and suggested checklists are provided in GOP's 3-1-1 and 3-1-2 to aid personnel participating in reviews.

2. APPLICABILITY

This policy is applicable to RM&QA personnel participating in design reviews.

3. GENERAL PROVISIONS

RM&QA personnel assigned to participate in design reviews shall be responsible for reviewing all design data furnished by a design agency to assure data, as a minimum, includes the following:

- a. Identification and data retrieval requirements.
- b. Identification of critical hardware characteristics necessary for procurement and fabrication.
- c. Inspection and test criteria.
- d. Performance and/or tolerance limits.
- e. Contamination control requirements and specifications.
- f. Process control requirements, specifications, standards, and procedures.
- g. Limited life items.
- h. Acceptance/rejection criteria.
- i. All documentation required at specified design review milestone.
- j. Qualification test.

- k. Mandatory inspections.
- l. Human factors assessment demonstrate that design development, hazardous/critical operations, procedures, and equipment have been evaluated to ensure effective integration of the human element.
- m. In addition, RM&QA personnel or other personnel when assigned these functions shall perform, review, and evaluate failure mode and effect analyses, critical items lists, and other analyses, as appropriate, to assure reliability requirements are being considered in the designs. Particular attention shall be given to:
  - (1) GSE end item function and use shall include an evaluation of the equipment's use in turnaround flow activities and probable result of equipment failure on the turnaround process.
  - (2) Failure Mode & Effect Analyses (FMEA's) shall be evaluated to assure Single Failure Points (SFP's) have been properly identified, and listed on the Critical Items List (CIL) with the correct criticality category code. Documented rationale for decisions to accept SFP's shall also be evaluated for impact on reliability and quality aspects of end use and function of equipment. These requirements are not only applicable to flight hardware but to Ground Support Equipment (GSE) having a direct interface with flight hardware and station sets where hazardous flammability problems could result in vehicle damage.

#### 4. CHECKLISTS

GOPs 3-1-1 and 3-1-2 provide checklists to be used as guides by personnel performing design reviews. These checklists are not all inclusive. Common sense and good judgment will be required for all designs, especially those of an unusual nature.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 3-1-1**

**SUBJECT: DESIGN REVIEW(S) RELIABILITY CHECKLIST**

1. Has criticality of equipment/system been established?
2. Have FMEA's been performed?
3. Are FMEA's adequate?
4. Has a Critical Item List (CIL) been prepared?
5. Are critical items properly coded on the CIL?
6. Are specific reliability design criteria specified?
7. Has an adequate testing/certification/verification program been established?
8. Has ALERT/GIDEP data been used for guidance in selection of parts/materials?
9. Have parts of unknown reliability been identified?
10. Have state-of-the-art parts or problems been identified?
11. Has the shelf life of selected parts been determined?
12. Have limited life parts been identified and inspection and replacement requirements specified?
13. Has the need for selection of parts (matching) been eliminated?
14. Has redundancy been provided where needed to meet reliability goals?
15. Has fail safe design philosophy been used?
16. Is protection against secondary failures (resulting from primary failures) incorporated where possible?
17. Have provisions been made for reliability documentation of all vendor-supplied components?

18. Has design been coordinated with the using organization for function and simplicity?
19. Has standard parts usage been maximized, thereby reducing needs for qualification tests and nonstandard part procedures?
20. Have time/cycle requirements been identified?
21. Is reliability demonstration testing and/or qualification and acceptance testing of components and parts required?

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 3-1-2**

**SUBJECT: DESIGN REVIEW(S) QUALITY CHECKLIST**

1. Have references to all applicable construction specifications and special processes been included (e.g., welding, soldering, cleaning, potting and molding, heat treating, etc.)?
2. Do specifications provide for adequate inspections, tests, and performance validations?
3. Does the design comply with specifications as set forth in various industry and KSC facilities specifications/standards?
4. Have vendor R&QA programs and histories been reviewed for specific item pertinent to design experience and/or fabrication capabilities?
5. Have provisions been made for adequate electrical/mechanical color coding?
6. Have critical fabrication operations and performance parameters been identified to provide for adequate mandatory inspections?
7. Is special handling of any items required?
8. What special equipment is required for test and checkout of unit? What are the calibration requirements (e.g., specifications, procedures and recalibration interval)?
9. Are cables and wire bundles routed to preclude pinching and chafing by doors, covers, and sharp edges?
10. Is each pin on each plug identified?
11. Are plugs designed to preclude insertion in the wrong receptacle?
12. Are soldering requirements adequately specified?
13. Do cable and wire bundle bend radii conform to specifications?



14. Is wiring and cabling designed to:
  - a. Provide grommets where needed?
  - b. Minimize soldering iron burns during manufacture and maintenance?
  - c. Provide for adequate lacing?
  - d. Be properly routed and clamped to prevent cables and bundles from hanging loose?
  - e. Provide adequate breakouts to connectors?
  - f. Match heavy wires to terminals that are large enough?
  - g. Secure stranded wires to solder joints to prevent flexing?
  - h. Provide visibility and accessibility to terminals?
  - i. Include adequate wire and cable identification?
15. Has equipment been designed to provide adequate operator workspace?
16. Have test parameters and acceptance/rejection criteria been established?
17. Have corrosion control requirements been identified?
18. Are quality requirements such that special training for inspectors is required? If so, what are the training and certification requirements?
19. Have applicable packaging requirements been considered and invoked?

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 3-2**

**SUBJECT: GOVERNMENT-INDUSTRY DATA EXCHANGE PROGRAM (GIDEP) AND  
KSC ALERT SYSTEM**

1. PURPOSE

This policy sets forth Kennedy Space Center (KSC) responsibilities and requirements for participation in Government-Industry Data Exchange Program (GIDEP).

2. APPLICABILITY

- a. This procedure applies to all organizational elements at KSC and their associated contractors to the extent specified in their respective contracts.
- b. This procedure covers KSC support and use of GIDEP in the acquisition, dissemination, storage and retrieval of reliability and qualification information, and calibration procedures.
- c. This procedure also covers the KSC ALERT System for immediate reporting of significant problems of general concern involving parts, materials, and safety.
- d. This procedure does not cover the exchange of classified information, government specifications, or contractor(s) proprietary information.

3. DEFINITIONS

For the purpose of this procedure, the following definitions apply:

- a. Agency Action Notice (AAN): An AAN redistributes problem information issued by a Government agency to notify GIDEP participants of problems and actions taken. Some AANs distribution may be limited to Government agencies only, as determined by the submitter.
- b. ALERT: A report, which provides the participant with wide, early, and rapid notification of significant part or material problems of general concern or significant safety (SAFE-ALERT) problems.

- c. Diminishing Manufacturing Sources and Material Shortages (DMSMS) Notices: These notices report (1) the end of production by an end item manufacturer or materials supplier, or (2) item disposition by the item manager or other Government activity.
- d. GIDEP Data Interchanges
  - (1) The ENGINEERING DATA INTERCHANGE (EDI) contains engineering evaluation and qualification test reports, nonstandard parts justification data, parts and materials specifications, manufacturing processes, failure analysis data, and other related engineering data on parts, components, materials, manufacturing processes, systems, and equipment. The EDI also includes a section of reports on specific engineering methodology and techniques, air and water pollution, alternate energy sources, and other subjects. It is available on 16-mm microfilm and supplemented with a computerized and hard copy index, abstracts, and hard copy summary sheets.
  - (2) The METROLOGY DATA INTERCHANGE (MDI) contains related metrology engineering data on test systems, calibration systems, and measurement technology and test equipment calibration procedures. The MDI is available on 16-mm microfilm and supplemented with a computerized hard copy index.
  - (3) The FAILURE EXPERIENCE DATA INTERCHANGE (FEDI) contains objective failure information generated when significant problems are identified on parts, components, processes, fluids, materials, or safety information. The FEDI is computerized to provide source data collected into selected indices and summaries. Source documents are contained on 16-mm microfilm in the FEDI as a permanent record.
  - (4) The RELIABILITY-MAINTAINABILITY DATA INTERCHANGE (RMDI) contains failure rate, mode, and replacement rate data on parts and components based on field performance information or reliability demonstration tests of equipment, subsystems and systems. The Reliability-

Maintainability Data are abstracted for computer retrieval and also distributed as hardcopy summaries. Reports and source data are contained on 16-mm microfilm.

- (5) The PRODUCT INFORMATION DATA INTERCHANGE (PIDI) contain notices of discontinued items, alternate parts sources, focal points for diminishing manufacturing sources and materials shortages, and secondary market manufacturers. It also contains notices from manufacturers of changes to their products that affect form, fit, or function. This database electronically distributes DMSMS Notices, Product Change Notices, and related information affecting the industrial and material readiness of government equipment. The PIDI contains Product Change Notices (PCNs) of manufacturer product changes. The PCNs are Class 1 changes as defined in MIL-STD 973, affect form, fit, or function.
- e. GIDEP Operations Center (GOC): The center is operated by the U.S. Navy in Corona, California. The center's functions are to manage the GIDEP system and maintain the interchanges for all data collection, processing, and distribution.
- f. Input Data: Reports forwarded to GIDEP.
- g. NASA ALERT: Correspondence, Teletype Wire Transmissions (TWT), Failure Notices, bulletins, etc., originated by NASA organizations, of ALERT/SAFE-ALERT nature, which affect NASA systems and equipment.
- h. Output Data: Microfilm, hardcopy, report listings, etc., distributed by GIDEP.
- i. Part/Material: A term which encompasses all grades of standard and special design items including:
  - (1) All mechanical, hydraulic, pneumatic, electrical and electronic parts, microcircuits, and microcircuit modules.
  - (2) Materials used in aerospace structures; such as, ferrous and nonferrous metals, plastics, sealant, adhesives, lubricants, insulation, wire, solders, fluxes, shielding, hose, tubing, and hydraulic fluids.

- j. Part/Material Problem: A term which means during any phase of an item's life cycle after manufacturer's release, a part/material evidences one or more of the following:
  - (1) Failure or potential failure.
  - (2) Malfunction.
  - (3) Part design limitation.
  - (4) Application limitation.
  - (5) Unexpected incompatibility.
  - (6) Unexpected deterioration, degradation, or contamination.s
  - (7) Unsafe condition.
- k. Problem Advisory: A Problem Advisory includes the reporting of one of the following:
  - (1) Preliminary information on a suspected problem.
  - (2) A problem with parts, components, materials, manufacturing processes, specifications of test equipment has an unknown or low probability of causing a functional failure.
- l. Problems of General Concern: Part, material, and safety problems may occur in other applications. Excluded are problems caused by improper handling, misapplication, and secondary failures, or problems caused by flagrant neglect or carelessness.
- m. Product Change Notice PCN: Reports major Class 1 form, fit, or function changes in parts, components, or materials used by the government in accordance with MIL-STD 480. The item manufacturer issues PCNs.
- n. SAFE-ALERT: A report used to rapidly disseminate information on a significant safety problem of general concern. A SAFE-ALERT may or may not involve a specific part or material.

- o. Safety Problem: A situation which results in, or could result in, loss of life, injury to personnel, or a loss of, or damage to, property.
- p. Significant Problem: A problem which can:
  - (1) Cause loss of life or serious injury to personnel, or result in major damage to, or loss of, property.
  - (2) Cause major delays in schedules.
  - (3) Have a high probability of occurring in flight hardware or critical GSE.
- q. Urgent Data Request (UDR): A report which provides rapid means of communication to enable GIDEP participants to obtain information not immediately available within the GIDEP interchanges or readily accessible from known sources.

#### 4. BACKGROUND

- a. The GIDEP is a cooperative data exchange among Government agency and Industry participants. GIDEP provides for the retrieval and dissemination of reliability, qualification test, and usage information on parts, materials and components; test equipment calibration procedures; and other reliability data obtained in the development of field-operation testing of military systems, aerospace systems, and other such systems and equipment of interest to the GIDEP participating organizations. This includes, but is not limited to, results of controlled tests conducted and calibration procedures developed by GIDEP members engaged in design, research and development, production, and support of equipment for the Government.
- b. Primary emphasis is placed on the results of user tests rather than vendor tests. Data is stored in one of four data interchanges: the Engineering Data Interchange; the Metrology Data Interchange; the Reliability-Maintainability Data Interchange; and the Failure Experience Data Interchange.
- c. The GIDEP objectives are to reduce or eliminate expenditures for developing parts and components for

new systems; increase the confidence level of the reliability data for parts and components; expedite research and development projects by avoiding repetition of accomplished tests; and provide an advanced indication of possible part and component failure modes.

- d. KSC participates in GIDEP to reduce costs by eliminating or minimizing duplication of reliability and qualification tests, test equipment calibration procedures, and recurrence of parts, materials, and safety problems.

5. GENERAL PROVISIONS

- a. The KSC GIDEP files and retrieval system is located within the KSC Headquarters Building, SH&IA Directorate.
- b. Data submitted to the GIDEP Operations Center (GOC), operated by the U.S. Navy, must be clear and clean.
- c. When reports are over 150 pages, three copies must be submitted with GIDEP forms, as reports are not microfilmed.
- d. The organizational GIDEP contact point, to the KSC GIDEP Representative for appropriate recognition shall submit all cost savings, for the GIDEP participant.

6. GENERAL PROCEDURES

- a. Processing of Input Technical Data to GIDEP
  - (1) Materials test facilities shall submit failure analysis, malfunction investigation, evaluation reports, and qualification test reports to the GIDEP organizational contact for consideration of submittal to GIDEP.
  - (2) The GIDEP organizational contact shall screen reports, summarize selected reports in GIDEP test report format, and forward to KSC GIDEP representative.
  - (3) The GIDEP representative shall forward a copy of the report, by letter, to vendor for comments. After two weeks, with or without vendor comments,

reports are released for transmittal to GOC. Manufacturer notification is not required for a report, which has been released by Government agencies to the general public.

- (4) KSC GIDEP Representative shall forward the report(s) to the GOC.

b. Processing Calibration Data

- (1) The Standards and Calibrations laboratories prepare calibration procedures and forward them to the KSC GIDEP calibration representative.
- (2) The KSC GIDEP calibration representative forwards the procedures to the GOC.

c. Processing and Utilization of Output Technical Data from GIDEP

- (1) The KSC GIDEP Representative receives all technical output data from GOC and forwards, as appropriate, information to the users.
- (2) The KSC GIDEP Calibration Representative receives the calibration data and forwards appropriate information to the users.
- (3) The KSC GIDEP Representative integrates the technical output data into the KSC GIDEP system, announces availability of selected new reports in periodic newsletters, maintains GIDEP provided indices of technical reports, test, data, and other information contained in GIDEP microfilms.
- (4) Upon request, the KSC GIDEP Representative searches indices for required data and assists in data retrieval. If requested data cannot be located in the GIDEP indices, GOC storage and retrieval facilities are queried.

d. Submission of Reports to GOC

- (1) Technical Data Reports: The KSC GIDEP representative shall prepare an annual progress report at the end of each calendar year and forward the report to the GOC.



- (2) Calibration Data Reports: The KSC GIDEP calibration representative shall forward to GOC, on an individual basis, a cost-benefit report on each procedure requested and received.

7. KSC ALERT SYSTEM

a. Initiation, Coordination, and Distribution of ALERTs/SAFE-ALERTs

- (1) The GIDEP representative is the single point of coordination within KSC and other NASA installations, NASA Headquarters, other Government agencies, and manufacturers.
- (2) An ALERT/SAFE-ALERT will be prepared on each significant part, material or safety problem of general concern identified by KSC or contractor organizations.
- (3) Anyone may initiate an ALERT/SAFE-ALERT. Prior to publication, an ALERT/SAFE-ALERT shall be reviewed by the originating organization's GIDEP contact point. The KSC GIDEP representative shall approve all KSC originated ALERTs/SAFE-ALERTs.
- (4) External ALERTs/SAFE-ALERTs are received by the GIDEP representative and distributed in accordance with an internal ALERT distribution list compiled from distribution requirements furnished to the KSC GIDEP Representative by each organizational GIDEP contact point.
- (5) Responsibility for assuring appropriate corrective action is accomplished on incoming ALERTs is primarily the functions of the GIDEP contact point. KSC shall not screen incoming ALERTs for applicability to flight hardware and GSE design under the cognizance of other NASA Centers. KSC will, however, react to requests for corrective action from other NASA Centers.

b. Problem Evaluation: Types of part, material, and safety problems (GOP 3-2-1) to be reported include, but are not limited to, the following:

- (1) Unusual failures or potential failures of items under normal operating storage conditions.
  - (2) Previously unidentified damage or deterioration of physical or functional characteristics of either part or material as a result of equipment fabrication methods and processes. Methods and processes include assembly, bonding, cleaning, coating, encapsulation, handling, sealing, soldering, and welding.
  - (3) A series of isolated failures of same part/material that may be indicative of a failure trend.
  - (4) Nonconformance of parts/materials to procurement specifications due to manufacturer's engineering or fabrication changes.
  - (5) Nonconformance of items to recognize safety codes or standards resulting in hazards or potential hazards.
  - (6) Failure or malfunction of safety devices, equipment, apparatus, or systems.
  - (7) Applications, operations, or procedures that have been found to adversely affect safety.
  - (8) Safety problems outside NASA that could occur within NASA and for which it has been determined the problem should not be reported in GIDEP or its reporting is of immediate urgency.
- c. Report Form: GIDEP Form 97-1 shall be used for ALERTs and SAFE-ALERTs to establish a uniform record of each problem or potential problem. ALERT numbers (assigned by the KSC GIDEP representative for KSC initiated ALERTs) shall include the letter A, and SAFE-ALERT numbers shall include the letter S; e.g., N4-A-75-01 and N4-S-75-01.
- d. Report Preparation: All of the information included in the report shall be objective and factual; care must be taken to assure good background material is obtained and included in the report. The ALERT/SAFE-ALERT preparer shall:

For hardware, include in the report:

- (1) Positive identification of failed hardware,  
including lot/serial numbers.
- (2) Name of manufacturer, procurement document number,  
and name of supplier, if pertinent to failure.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 3-2-1**

**SUBJECT: ALERT SYSTEM - EXAMPLES OF PROBLEMS FOR ALERTS  
AND SAFE-ALERTS**

1. EXAMPLES OF PROBLEMS FOR ALERTS

- a. Faulty Design. Design of a particular coaxial connector did not allow entry of pin into socket until after engagement of nut, nor was the pin held rigidly in place within the connector. Consequently, weight of cable or any other force could displace pin from centerline of the socket. These conditions resulted in misalignment of pin during assembly, causing it to enter between socket and Teflon dielectric, which subsequently distorted or broke one or more sections of split sockets.
- b. Faulty Production Techniques. Failure analysis of a relay led to the following comment by an examining agency: Cause of failure is attributable to internal contamination. Contamination consists of metallic particles and slivers, solder splash and balls, weld splash and balls, nylon/Teflon particles and strings, bristle or hair, and an unidentified white powder. Investigation at manufacturer's plant indicates all relays from a particular line are contaminated with metallic and nonmetallic particles.
- c. Potential Problem Condition. Corona discharge was detected during use of a resistor under high voltage operation. Discharge was traced to improper evacuation when an otherwise acceptable resistor was protected during potting by installation of a heat-shrinkable tubing sleeve. Corona resulted between the tubing wall and the resistor surface.
- d. Unusual Failure Under Normal Operation. Resistance of metal film resistors increased as much as 50% after operating at low power levels. When operated at only 20-30% of rated voltage, metal migration occurred in the resistive film due to contamination. Migration occurred when a polarizing voltage was applied over an extended period of time and was accelerated when insufficient energy dissipated in resistor to vaporize moisture off metal film.

- e. Follow-up ALERT to a Previous Problem. Initial ALERT described a problem wherein a transistor failed to open due to an internal bond wire fracture. Fracture occurred because narrow wire at heel of bond eventually fatigued after being subjected to repeated mechanical flexing caused by power switching application. Subsequent ALERTs reported progress of further investigations of problems. The addenda included test results that isolated critical power and frequency conditions and identified wire bond systems and controls that would eliminate failure mode.

## 2. INFORMATION NOT TO BE INCLUDED IN ALERTS

ALERT is intended to define an actual or potential problem of general concern, not to report a normal failure of a part or material, nor testing rejections normally expected for untested or sample tested parts. In order to ensure information in the ALERT system is not diluted by nonrelevant data, certain types of information should be kept out of the system. ALERTs should not be submitted in the following situations:

- a. Problem Attributable to Secondary Cause. The fact a device in an operating circuit failed because power supply went out of regulation is of no use or value to other participants. However, reason for failure of power supply may well be of interest.
- b. Problem Not Traceable to a Specific Part or Material. If it has not been possible to trace a system or equipment failure to failure of a specific part or material, the fact a failure occurred is not of general interest. Enumerations or tabulations of systems failures are not pertinent to ALERTs.
- c. Problem Caused by Human Factor. Cases of human error which produce failures in parts or materials generally are of no concern to other participants. However, if detection of such cases may help in solution of industry wide unsolved problems, disclosure by an ALERT may be acceptable.
- d. Problem Resulting from Misapplication or Misuse. If a failure occurred because a part or material was stressed beyond its known and specified capabilities, the failure is generally of no concern to other participants.

3. EXAMPLES OF PROBLEMS FOR SAFE-ALERTs

- a. Hazardous Condition. Design of a particular resuscitator revealed certain internal parts were not oxygen compatible. This rendered the resuscitator useless under emergency conditions. Investigation revealed the manufacturer was not aware of this problem, and that this model resuscitator was in wide use.
- b. Unsafe Practice or Application. A pneumatic differential pressure gauge was being used between two high-pressure systems. While gauge was operating within differential limits of gauge, its maximum pressure was exceeded. This caused the front glass of the gauge to blow out and injure the operator. In addition to operating this gauge above its range, this particular case also pointed out a design deficiency wherein the gauge did not have a blowout plug or line restrictor to prevent glass from being expelled.
- c. Faulty Production or Processing Techniques. The rim holding seat of an ordinary office swivel chair failed when the occupant leaned back causing the occupant to take a severe fall, landing on his back. This failure was attributed to the bend radius of the rim being too small, causing metal fatigue.

4. INFORMATION NOT TO BE INCLUDED IN SAFE-ALERTs

SAFE-ALERT is intended to define an actual or potential hazard or safety problem of general concern, not to report normally recognized industrial or system safety problems. As with ALERTs, the system shall not be diluted by nonrelevant data. For example, it would not be appropriate to report oil accidentally spilled on the floor and might cause someone to fall.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 3-3**

**SUBJECT: KSC MAINTAINABILITY POLICY**

1. PURPOSE

This policy sets forth Kennedy Space Center (KSC) responsibilities and requirements for complying with the NASA maintainability requirements of NPD 8720.1, NASA Reliability and Maintainability Program Policy.

2. APPLICABILITY AND SCOPE

This policy applies to all organizational elements at KSC involved with the design, development, and sustaining engineering of KSC systems and equipment.

3. GENERAL PROVISIONS

- a. It is KSC policy to ensure KSC GSE and facility systems incorporate design features, which facilitate ease of maintenance and repair. Specific maintainability design criteria shall be selected based upon mission needs and life cycle cost considerations.
- b. Project managers for newly developed or procured KSC systems and equipment are responsible for identifying project maintainability design requirements and ensuring their accomplishment.
- c. Sustaining engineering organizations are responsible for ensuring modifications to systems and equipment do not adversely impact maintainability design features and system maintainability issues are identified for correction during modification projects.
- d. KSC Safety, Health and Independent Assessment is responsible for establishing policies and preferred methodologies and standards for the application of maintainability and providing consultation and insight to assure maintainability processes are incorporated effectively in KSC projects, including integration with safety and reliability activities.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 3-4**

**SUBJECT: NASA STANDARD PARTS PROGRAM**

1. PURPOSE

This policy sets forth guidelines and assigns responsibilities for complying with the NASA Standard Parts Program as defined in NPD 8730.2. This NPD designate KSC as a user center in the program, and Goddard Space Flight Center (GSFC) as the lead center.

KSC policy is to use quality Electrical, Electronic, and Electromechanical (EEE) parts commensurate with the criticality of the application and the life cycle cost.

2. APPLICABILITY AND SCOPE

This policy applies to all KSC organizations involved in parts selection, procurement, application, and testing. It covers new facilities, systems, and equipment for new programs and projects under the cognizance of KSC, and outlines how KSC will accomplish the established user center tasks.

3. DEFINITIONS

For the purpose of this procedure, the following definitions apply:

- a. Grade 1: The classification used for higher quality standard parts intended for applications where either:
  - (1) Part performance is critical to safety.
  - (2) Part performance is critical to mission success.
  - (3) Maintenance or replacement is extremely difficult or impossible, and failure would cause major mission degradation.
- b. Grade 2: The classification used for standard parts which meet minimum criteria for inclusion in the NSPL, and are intended for applications not requiring Grade 1 parts.



- c. Mission-Essential Ground Support Equipment: Ground Support Equipment (GSE) whose operation is essential to successful mission performance; or whose problems can create a safety hazard adversely affecting mission performance, or cause flight hardware malfunction or damage, or inability to detect a flight hardware or software problem.
- d. Nonstandard Part: An electronic part that is not approved for listing in MIL-STD-975 or other applicable NASA approved parts lists, i.e., SSP30423, "Space Station Approved Electrical, Electronic, and Electromechanical Parts Lists (SSAEPL)," and which fits one of the applicable Federal Stock Classes (i.e., 5905, 5910, 5915, 5920, 5935, 5950, 5961, 5962, or 6145). Grade 2 parts used in Grade 1 applications are nonstandard.
- e. Standard Part: An electronic part approved for listing in MIL-STD-975 or other applicable NASA-approved parts list, i.e., SSP30423.

#### 4. GENERAL PROCEDURES:

The following defines the procedures for parts selection in KSC designs:

- a. The design organization shall recommend the appropriate grade and application of EEE parts to be used in the design, or major modification of GSE and facility equipment, based on the approved system criticality and the following criteria:
  - (1) System design and application shall be in accordance with KSC-DE-512-SM, "Guide for Design Engineering of Ground Support Equipment and Facilities for Use at Kennedy Space Center."
  - (2) Systems that interface with flight hardware and could cause a catastrophic condition (Criticality 1; refer to NOTE) shall be candidates for application of Grade 1 EEE parts as defined by MIL-STD-975, "NASA Standard Electrical, Electronic, and Electromechanical (EEE) Parts List," and other approved EEE parts lists.

- (a) Selection determination of Grade I EEE parts shall be based on the specific circuit function and its associated criticality.
  - (b) Specific applications shall be determined by the designer, coordinated with SR&QA, and approved by the responsible NASA KSC design agency prior to implementation.
  - (c) Grade I parts for use in GSE generally do not require radiation hardening.
  - (d) When a Grade I part cannot be procured for a special application, the design organization shall initiate, and process the EEE part deviation per cognizant program requirements.
- (3) Equipment interacting with flight hardware which could result in mission essential hardware failure or damage (Criticality 1S, 1R, or 2; refer to NOTE) shall be candidates for Grade 2 EEE parts.
- (a) Selection determination of Grade 2 EEE parts shall be based on the specific circuit function and its associated criticality.
  - (b) Specific applications shall be determined by the designer, coordinated with SR&QA, and approved by the responsible design organization.
  - (c) Grade 2 includes screened and burned-in, high grade, Military Standard parts.
  - (d) Where Grade 2 parts are not available, the design organization shall: designate a higher grade of part; or initiate an appropriate test and screening program.
  - (e) A higher grade of part can be recommended in accordance with paragraph 5a(2) above, where it can be shown to be cost effective from a life cycle costing standpoint.
  - (f) Commercial off-the-shelf equipment identified for critical application shall require review and approval by the cognizant program organization.

- (g) Burn-in accomplished at the board or assembly level does not eliminate the requirement for derating, screening, and burn-in of replacement parts.
- (4) Part selection for systems that do not interface with flight hardware, and would not result in a catastrophic condition, or cause vehicle and payload damage (Criticality 3; refer to NOTE), shall be based on part availability and life cycle costs. Life cycle costing considerations generally preclude the use of commercial grades of parts.
- b. The design organization shall specify the appropriate grade of parts on the hardware and system documentation. Part descriptions will reflect this information for procurement purposes.

NOTE: Use appropriate definition of criticality. (Refer to NSTS 22206, "Requirements for Preparation and Approval of Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)," and SSP 30234, "FMEA and CIL Requirements.")



## SECTION 4: PROCUREMENT

### 4.1 GENERAL

The Reliability, Maintainability and Quality Assurance (RM&QA) Programs shall assure the adequacy and quality of all purchased articles, materials, and services. Procurement quality activities shall be planned, implemented, and maintained to provide timely integration with other Center activities. The SH&IA Directorate shall participate in proposal or bid evaluation through the Source Evaluation Board (SEB). Turn-in and disposal processes shall be implemented for excess Government Property. Program functional responsibilities shall include the following:

- a. Making recommendations to the contracting officer pertaining to the adequacy of RM&QA provisions which will be considered in selections of procurement sources.
- b. Developing of RM&QA requirements for procurements.
- c. Participating in preaward and postaward surveys of potential suppliers.
- d. Providing technical assistance and training to contractors, when necessary, to achieve desired quality levels.
- e. Recommending to the contracting officer RM&QA and inspection system provisions be approved or disapproved. Recommending changes needed to make procurement documents with RM&QA requirements acceptable.
- f. Providing source inspection, when necessary, based upon criticality, complexity, and cost of the particular procurement.
- f. Turning-in, excessing and disposal of Government Property in accordance with KHB 4000.1, Part 8, Section 5, "Turn-in of Material and Equipment."

### 4.2 CYCLE

R&QA personnel shall participate in the procurement cycle from definition of requirements through procurement operations and ultimately the receipt and inspection/acceptance of hardware.

#### 4.3 DOCUMENTATION

Procurement documents shall be reviewed to assure inclusion of RM&QA requirements based upon criticality, complexity, and the cost of the hardware/materials involved.

#### 4.4 SOURCES

R&QA personnel shall support the contracting officer in the selection of procurement sources and assure each procurement source has a previous and continuing record of supplying reliable and quality products; where this cannot be determined by review of RM&QA records, pre-award surveys shall be conducted, when requested by the contracting officer, to determine potential capability of source to meet NASA/KSC requirements.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 4-1**

**SUBJECT: SRM&QA REQUIREMENTS IN PROCUREMENT DOCUMENTS**

1. PURPOSE

This policy defines responsibilities and provides definitions, general provisions, and criteria for ensuring appropriate Safety, Reliability, Maintainability and Quality Assurance (SRM&QA) requirements are developed and incorporated in Kennedy Space Center (KSC) procurement requests, Statements of Work (SOW) for KSC contracts, subcontracts/purchase orders let by onsite and certain offsite contractors, and all other procurement documents.

2. APPLICABILITY AND SCOPE

This policy applies mainly to all KSC Reliability, Maintainability, and Quality Assurance (RM&QA) activities, and to NASA activities operating at KSC participate in developing SRM&QA provisions for procurement documents, including SOW provisions. The policy applies to a lesser extent to Safety activities for which equivalent coverage is provided in dedicated Safety documentation, particularly the KHB 1710.2 Handbook. This policy also applies to onsite and certain offsite contractors to the extent provided for in their respective contracts. The SRM&QA requirements shall be appropriately tailored to the procurement. Consideration shall be given to the factors of criticality, complexity, state of the art, costs, types of services, and schedules associated with the procurement.

3. GENERAL PROVISIONS

- a. Requirements for KSC contractors to incorporate SRM&QA provisions in procurements shall be included in KSC contracts. The originating organization and the Director of Safety, Health and Independent Assessment shall assure the implementation of this requirement, by monitoring the preparation of contractor procurement documents and contractor controls over subcontractors and suppliers, through audits, surveillance, or by other means of evaluation.
- b. RM&QA organizations and personnel assigned RM&QA functions are responsible for preparing and/or reviewing RM&QA provisions in the SOWs of proposed procurement actions. The intent of the Federal

Acquisition Regulations (FAR) shall be implemented by tailoring proposed contract requirements to specific procurements, based on operational requirements, criticality and complexity of work, and cost effectiveness.

- c. Each paragraph in the applicable program requirement documents shall be evaluated to determine applicability to KSC operations and the particular procurement. Where necessary, paragraphs shall be modified or eliminated to tailor a SOW to specific KSC needs. The goal of this tailoring effort shall be the development of cost-effective, yet adequate KSC RM&QA programs. RM&QA program effectiveness shall not be sacrificed for cost savings; the goal should be a reasonable balance between RM&QA requirements and costs.
- d. RM&QA organizations shall maintain records, as applicable, which provide rationale for the selection, modification, and deletion of requirements.
- e. To provide tractability to higher level NASA RM&QA requirements and RM&QA provisions, SOWs shall be tailored in format to Section 4-1-1 of this GOP, which are sample requirements for a major element or mission support contract.
- f. The responsible RM&QA organization shall use good judgment and the guidelines in the FARs when considering a particular specification to be tailored. Rationale shall be documented and maintained in the organization's official record files.
- g. In competitive procurements, detailed plans shall be required within a reasonable time after award of the contract.
- h. GOP 5-1 governs incorporation of quality assurance requirements in contractor-prepared Support Requests.
- i. Reliability and maintainability requirements for new equipment or major modifications to existing equipment shall be included in the design requirement package by the responsible design and SRM&QA organizations.
- j. Procurement documents for design, engineering, or technical services at KSC and other NASA-KSC responsible facilities, including criteria or



specification documents transmitted to Department of Defense (DOD) agencies for contract administration, and for the acquisition of supplies and property as defined in the Federal Acquisition Regulation (FAR), shall contain appropriate and adequate SRM&QA requirements in accordance with KPD 8710.1, KHB 1710.2, the GOPs in this issuance, and the FAR.

- k. SRM&QA requirements included in procurement requests, statements of work, and other contractual documents shall not be changed or modified without the signed concurrence of all SRM&QA activities that concurred in the change of the particular contractual document. All organizations (originators and SRM&QA) have a responsibility to coordinate all procurement document requirement changes with the affected organization(s).
- 1. For NASA procurements, three copies of the contract or purchase order should be submitted to the procurement quality assurance organization.
- m. The responsible RM&QA organization shall assure applicable acceptance data package requirements, as specified in GOP 6-6, are invoked in procurements.
- n. When Government Source inspection is required at their Subcontractor Plants, KSC contractors shall obtain concurrence of the NASA procurement quality assurance organization. Following purchase order issuance to the subcontractor, the KSC contractor shall provide three copies to the procurement quality assurance organization.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 4-1-1**

**SUBJECT: SAMPLE REQUIREMENTS FOR SUPPORT CONTRACTS**

1. GENERAL REQUIREMENTS

The contractor shall develop, implement, and maintain an effective Reliability, Maintainability, and Quality Assurance (RM&QA) program to satisfy, as a minimum, the requirements of NSTS 5300.4(1D-2), Chapters 1, 3, and 5 and amendments as described below. If a paragraph of NSTS 5300.4(1D-2) is not deleted, modified, or supplemented in the following document, it is applicable to the contract as written.

2. RM&QA PLANS

Paragraphs 1D300.2 and 1D500.3 are deleted in their entirety, and the following is substituted:

Reliability, Maintainability, and Quality Assurance Program Plan

The offeror(s) selected for award of the contract shall submit a detailed RM&QA program plan which shall be subject to evaluation and approval before incorporation into the contract. This detailed plan shall:

- a. Have a format so each portion of the plan can be readily identified with each cited RM&QA requirement.
- b. Serve as master planning and control document for the contractor's RM&QA Program(s).
- c. Include charts and narrative statements describing each element of contractor's organization (e.g., procurement, engineering, reliability, fabrication, test, safety, and quality assurance) which implements the RM&QA program and detailed statements of duties, functions, and responsibilities relating to each RM&QA program task. The plan shall show the relationship of individuals managing RM&QA functions with each element performing tasks, including authority to control and monitor the cited tasks.
- d. Include narrative descriptions of the contractor's execution and management of each task. These shall be detailed in terms of when, by which organization, and

by which method each task will be accomplished. Applicable contractor policies and procedures shall be stated in the plan, either within task paragraphs of the plan or as an appendix or separate section of the plan with cross references to tasks cited. All RM&QA procedures shall be submitted as specified in Data Requirements Document/Data Requirements List (DRD/DRL).

- e. Include charts indicating the flow of fabrication and assembly operations and related inspection and test points.

### 3. INTRODUCTION

Delete last sentence of 1D102, and all of 1D102.1 through 1D102.6.

### 4. RELIABILITY

- a. Paragraph 1D300, between 2nd and 3rd sentences, and the following:

These reviews and analyses shall include:

- (1) System design reviews.
- (2) Workarounds and alternate modes of operations.
- (3) Analyses of failed components.
- (4) Analyses of design changes/modifications accomplished at KSC.

- b. Paragraph 1D300.3, delete entirely.
- c. Paragraphs 1D300.5a and b are considered applicable at KSC when local purchasing is required as a result of engineering changes and modifications. Procedures for implementing these requirements shall be compatible with those used under development contracts.
- d. Paragraph 1D301, delete the lead paragraph and substitute the following:

The contractor shall accomplish the following reliability engineering tasks:

- e. Paragraph 1D301.1, add the following:

This effort shall be limited to design and specification changes originating at KSC. Reliability analyses shall be in accordance with KSC GP-1040, Design Reliability Analysis Instruction.

- f. Paragraph 1D301.2, delete entirely.

- g. Paragraph 1D301.3, change the lead sentence to read as follows:

The contractor shall establish a system for the updating and maintenance of development center-supplied Failure Modes and Effects Analysis (FMEAs) and Critical Items Lists (CILs) that may changed as a result of design changes and modifications made at KSC. The system shall be in consonance with development center FMEA/CIL system.

- h. Paragraph 1D301.3a, delete entirely, and add the following:

The contractor shall prepare design FMEAs at the lowest level of system definition required to support potential uses (e.g., testing failure reporting, and corrective action, and selection of mandatory inspection points). FMEAs will be prepared to lowest level necessary to pursue all critical functions. Failure modes will be identified to piece part level when they are Criticality 1 or 2. The FMEA shall include an integration of all flight hardware, Government Furnished Equipment (GFE), and critical Ground Support Equipment (GSE). CILs shall be updated according to results of FMEAs.

- i. Paragraph 1D301.3b, delete entirely.

- j. Paragraph 1D301.3c, add the following:

The contractor shall provide documented evidence that critical items on CILs prepared under development Center contract and updated as required in item h are adequately tested and/or inspected during manufacturing and testing operations.

- k. Paragraph 1D301.4, delete entirely.

- l. Paragraph 1D301.5, delete entirely and replace with the following:

The contractor(s) reliability activities shall support all milestone reviews at KSC.

- m. Paragraph 1D301.6, delete last sentence from lead-in paragraph and add:

The contractor(s) system shall conform to the requirements of the KSC PRACA System.

- n. Paragraphs 1D301.6a, b, and c delete entirely.

- o. Paragraph 1D301.7, delete the 3<sup>rd</sup> and 4<sup>th</sup> sentences.

- p. Paragraph 1D301.8 and 1D301.9, delete entirely and add the following:

The contractor shall continue an Electronic, Electrical, Electromechanical (EEE) and mechanical parts control program and conduct materials specifications and application reviews; comply with development center contract requirements.

- q. Paragraph 1D302, delete entirely and substitute the following:

The contractor shall participate in KSC verification testing activities as required by the Launch and Landing Verification Test Plan and other associated documents.

## 5. QUALITY ASSURANCE

- a. Paragraph 1D500.3, delete and replace as noted in paragraph 2.

- b. Paragraph 1D500.8c, add the following:

Summaries of audits, including remedial and preventive action taken, and results of reviews of deficient areas shall be furnished to the cognizant NASA/KSC contractor management and quality organization every six months.

- c. Paragraph 1D501.1a, add subparagraphs as follows:

- (1) Technical Procedures Review: Contractors shall review technical operating procedures, as applicable, for the following criteria:
  - (a) Verification of calibration status and personnel certification.
  - (b) Clarity to minimize the possibility of human error.
  - (c) To eliminate characteristics that could compromise quality assurance and reliability functions.
  - (d) For inspection verification of critical actions, steps, or sequences, with system single failure point considerations as applicable.
  - (e) Inclusion of general reliability and/or quality provisions.
  - (f) All NASA requirements, such as man-loading system limits, acceptance criteria, special tools, and verification/certification points are identified. A list of contractor acceptance points shall be submitted to NASA/KSC. A list of NASA Mandatory Inspection Points (MIPs) and other requirements will be supplied to the contractor by NASA and revised on a periodic basis to add or delete items as required.
- (2) Work Authorizing Document Review: As required by GOP 5-1, the contractor shall review task orders, work orders, support requests, or any document that requires the expenditure of labor/materials/services, and shall record on each document the level of quality inspection required to satisfy contract requirements (i.e., in process and/or end item inspection). The review effort includes incoming as well as outgoing requests.

d. Paragraph 1D501.1b, add the following:

When contractor under authorizing documentation performs work, quality assurance shall verify

compliance to this requirement and shall perform those inspections required by the documentation.

- e. Paragraph 1D503.1, add the following between the first and second sentences:

The contractor shall issue purchase orders for flight hardware, critical GSE and spares at KSC. In cases where articles must be locally procured, the contractor shall utilize the KSC qualified vendor and parts list in making selections. The same receiving inspection criteria developed at the contractor's home plant will be used for locally procured hardware.

- f. Paragraph 1D503.4b, add the following:

Contractor procurements requiring contractor source inspection may be approved by the cognizant KSC quality organization.

- g. Paragraph 1D503.4c, delete entirely.

- h. Paragraph 1D503.6; add subparagraph "m" as follows:

Articles purchased by the design agency's contractor that have receiving inspection performed at contractor's facility and shipped to KSC will require identification and damage inspection at KSC.

- i. Paragraph 1D503.9b, add the following:

Contractor procurement surveys may have prior approval of the cognizant KSC quality organization.

- j. Paragraph 1D503.9c, delete.

- k. Paragraph 1D505.5a, add the following:

The contractor's procedures shall define the inspector's authority and method to be used to stop work and/or test due to personnel hazards or possible damage to flight hardware or GSE.

- 1. Paragraph 1D505.6a, add the following:

All Acceptance Data Packages and other equipment records shall be maintained current and updated continuously.

- m. Paragraph 1D505.9, add the following:

Training and certification requirements for quality assurance designees, implementing procedures, and designated personnel shall be approved by the cognizant KSC quality organization prior to implementation.

- n. Paragraph 1D505.10, add the following:

These controls shall preclude the entrance of unauthorized materials, tools, and personnel into specified test and checkout areas.

- o. Paragraph 1D505-12, change to read as follows:

Integrity Control. Transportation services as outlined in KHB 6000.1 shall be used by the contractor to ensure the hardware is not jeopardized through such operations as unpacking, receiving, inspection, storage, testing, installation, shipping, scheduled and unscheduled maintenance, operations, modifications and repairs. Positive controls shall be established, documented, and maintained by the contractor to ensure serviceability seals and tags will be used to indicate the condition of equipment not installed in a system or subsystem, to seal segments of installed systems from which portions have been removed, to indicate status of the remaining installed equipment, and to seal controls, covers, doors, etc., of equipment to provide an indication of the entry or possible alteration of equipment.

- p. Paragraph 1D506.1, add the following:

The Withhold Tag shall be used in identifying serious defects or unsafe conditions requiring immediate corrective action. The Withholding Tag is red in color and alerts personnel working on equipment of the existence of a serious problem. The contractor shall maintain a system to identify conditions such as:

- (1) Equipment overdue for calibration.
- (2) Unauthorized breaks of integrity.
- (3) Safety hazards.



- (4) Unauthorized work (additions/removals) that has changed the basic configuration.
- q. Paragraph 1D507.6a, delete and substitute the following:

The contractor shall use the services of the KSC Calibration and Standards Laboratory for the calibration of portable equipment and standards.
- r. Paragraph 1D509.6, add the following:

The contractor shall furnish packing and packaging instructions to NASA/KSC support contractors when requested.
- s. Paragraph 1D510.1, delete the second and third sentences and substitute the following:

Sampling inspection plans and/or procedures shall not be employed by the contractor to determine quality conformance of articles and/or services furnished under contract without prior approval of the cognizant KSC NASA quality organization.
- t. Paragraph 1D512, delete entirely.
- u. Add new paragraph, 1D513r Government-Industry Data Exchange Program (GIDEP), as follows:

The contractor shall develop and implement a GIDEP system that conforms to the requirements of KMI 5310.1.
- v. Add new paragraph 1D514, as follows:

1D514. Parts and Materials Control

  - 1. The contractor shall assure a physical separation of parts and materials is maintained to provide, as a minimum, separation of:
    - a. Parts and materials awaiting inspection or acceptance test results.
    - b. Parts and materials acceptable for stock.
    - c. Rejected items being held pending disposition.

- d. Bulk hardware common to flight hardware and GSE, which is controlled by the assignment of lot numbers.
2. The contractor shall establish and maintain a system for the identification and control of nonflight hardware in accordance with NASA/KSC requirements and JSCM 8080, STD. 99B. Shuttle flight critical hardware and Shuttle Safety Critical GSE shall be controlled in accordance with JSCM 8080, STD. 86.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 4-2**

**SUBJECT: PREAWARD SURVEYS**

1. PURPOSE

This policy establishes the requirement for the Reliability, Maintainability, and Quality Assurance (RM&QA) portion of preaward surveys of potential KSC contractors and suppliers and assigns responsibilities for performance and maintenance of the resulting records. When preaward surveys are delegated to Defense Contract Management Command (DCMC) or other agencies, this policy does not apply.

2. APPLICABILITY

The provisions of this policy apply to all KSC organizational elements having responsibilities for recommending, selecting, and approving procurement sources.

3. GENERAL PROVISIONS

- a. When a preaward survey is conducted to determine a prospective contractor's overall capability and responsibility, it shall be conducted in accordance with FAR 9.106 and NASA FAR Supplement, paragraph 18-9.106. Any such survey shall include a determination as to the adequacy of RM&QA capability.
- b. RM&QA personnel of the survey team shall plan and perform the RM&QA portion of the survey, gather and evaluate data sufficient to permit one of the following recommendations to be made as applies to RM&QA.
  - (1) Approval: Denotes acceptance of the procurement source RM&QA program, technical, and financial capabilities and facilities.
  - (2) Disapproval: Denotes procurement source is not acceptable for RM&QA, financial, technical, or facility inadequacy reasons.
  - (3) Conditional Approval: Denotes approval is contingent upon correction of deficiencies listed in the survey report. The survey team shall

specify a time period in which listed deficiencies are to be corrected.

- c. If a procurement source is given conditional approval of RM&QA capabilities by the survey team and deficiencies upon which conditional approval was based are not corrected within the time specified, the rating shall automatically default to "Disapproval." A re-survey of deficient areas may be conducted to determine if corrective actions taken by the procurement source are acceptable.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 4-5**

**SUBJECT: DELEGATION OF CONTRACT ADMINISTRATION SERVICES FOR THE  
PERFORMANCE OF RELIABILITY, MAINTAINABILITY, AND QUALITY  
ASSURANCE FUNCTIONS**

1. PURPOSE

The purpose of this policy is to define the minimum requirements of the John F. Kennedy Space Center (KSC) delegation and re-delegation of contract administration services for the performance of Reliability, Maintainability, and Quality Assurance (RM&QA) functions.

2. SCOPE AND APPLICABILITY

This policy covers all delegations and re-delegations of contract administration services for the performance of RM&QA functions and applies to all organizational elements of KSC.

3. DEFINITIONS

- a. Onsite: Any area within the confines of KSC and Vandenberg Air Force Base (VAFB) for which KSC has responsibility.
- b. Offsite: Any area outside the confines of KSC and VAFB.

4. GENERAL PROVISIONS

- a. Incoming Letters of Delegation. Letters of Delegation for contract administration services that contain RM&QA functions to be performed by or under the cognizance of KSC or any of its elements shall be directed to, and accepted for KSC, by the Procurement Officer. After review and concurrence by the cognizant division, which is to perform the delegated functions, the KSC contracting officer shall redelegate the responsibilities for these RM&QA functions, as appropriate.
- b. Onsite Performance by Another Government Agency. The RM&QA portions of letters of delegation, or re-delegation of contract administration services to be performed onsite by another Government agency, shall be

prepared by the Director of Safety, Health and Independent Assessment, before being sent to the agency.

- c. Offsite Performance by Another Government Agency. Letters of Delegation of contract administration services for KSC hardware procurements and services that contain RM&QA functions to be performed offsite by another Government agency or NASA installation shall be prepared as follows:
  - (1) The quality assurance portions shall be prepared by the quality organization and shall include mandatory characteristics identified, by the originating KSC organization.
  - (2) The reliability assurance portions shall be prepared by the reliability assurance element of the responsible KSC design organization and shall have the concurrence of KSC SH&IA.
  - (3) Each letter shall be signed by a KSC contracting officer.
  - (4) Authority for re-delegation of the performance of R&QA functions shall be included when, and to the extent, appropriate.
- d. Deletion or Alteration of Functions. R&QA functions established in accordance with this policy shall not be amended without the concurrence of the R&QA elements that concurred in their inclusion in the letters of delegation or redelegation.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 4-6**

**SUBJECT: QUALITY ASSURANCE TECHNICAL REPRESENTATIVES**

1. PURPOSE

This policy establishes basic requirements for assignment of quality assurance technical representatives.

2. APPLICABILITY

This policy applies to the procurement office and organizational elements responsible for quality assurance and covers supply or service contracts or portions of these contracts originated or administered by KSC. This policy does not apply to small purchases unless detailed technical inspection is necessary.

3. DEFINITIONS

- a. Quality Assurance: A general term used to describe the management of quality assurance and inspection operations. It includes quality assurance and inspection functions, technical direction and monitoring of contractor quality assurance and inspection functions, quality assurance and inspection functions delegated to KSC or from KSC to other government organizations, and contractor quality assurance and inspection functions. The objective of quality assurance is to assure compliance with organizational, contractual and/or delegated quality requirements.

NOTE: Any direction which alters term or conditions of a contract or delegation shall be provided through appropriate contract administration channels.

- b. Quality Assurance Technical Representative: A quality representative assigned or delegated to perform quality assurance or quality control functions defined herein as quality assurance.

4. GENERAL PROVISIONS

- a. When quality assurance functions are not delegated to another NASA installation or Government agency, a Quality Assurance Technical Representative shall be assigned for all technical hardware contracts. When quality assurance functions are delegated to another NASA installation or Government agency, a Quality Assurance Technical Representative shall also be assigned. This assigned person shall serve as the point of contact responsible for the performance of quality assurance functions.
  - (1) The representative shall be the chief of the division or office organizationally responsible for quality assurance, or his nominee.
  - (2) The assignment shall be made by letter from the contracting officer to the representative and to the contractor.
  - (3) Blanket letters of assignment may be used when appropriate for classes or groups of smaller dollar value contracts.
- b. When contract administration functions which include quality assurance are delegated to KSC by another NASA installation or by another Government agency, the quality assurance functions shall be redelegated to a Quality Assurance Technical Representative.
  - (1) This redelegated Quality Assurance Technical Representative shall be chosen by the chief of the division or office organizationally responsible for quality assurance of contract.
  - (2) A letter stating the duties and authority are redelegated shall make the redelegation.
  - (3) The name and address of the Quality Assurance Technical Representative shall be forwarded in writing to the contractor and delegating installation or agency.
- c. When KSC delegates or re-delegates quality assurance functions to another NASA installation or to another Government agency, a Quality Assurance Technical Representative shall be named in the letter of delegation or re-delegation. The Quality Assurance Technical Representative shall be chosen by the chief



of the division or office organizationally responsible  
for quality assurance of the contract.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 4-7**

**SUBJECT: SOURCE INSPECTION**

1. PURPOSE

This policy establishes basic methods for development and implementation of Source Inspection requirements at KSC.

2. APPLICABILITY

This policy applies to all organizations responsible for assuring Government Source Inspection.

3. GENERAL PROVISIONS

- a. Determinations of need for source inspection shall be made as early as possible in the procurement cycle.
- b. Source inspections, performed by and for the convenience of the Government, does not in anyway replace contractor inspections or relieve the contractor of responsibilities for ensuring product quality.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 4-8**

**SUBJECT: RECEIVING INSPECTION**

1. PURPOSE

This policy establishes quality assurance controls for receiving inspection functions at KSC.

2. APPLICABILITY

This policy applies to KSC/contractor organizational elements responsible for receiving inspection functions. Contractors are responsible only to the extent specified by contract.

3. GENERAL PROVISIONS

- a. A documented receiving inspection control system shall be implemented to ensure:
  - (1) Procured articles and materials indicate evidence of inspections and tests performed by the contractor/vendor in accordance with the contract/purchase order, and are accompanied by required hardware and software Acceptance Data Packages.
  - (2) Articles and materials or accompanying records exhibit evidence of contractor and Government source inspection (as required).
  - (3) The contractor/vendor inspection data is acceptable by performing inspections and tests of selected characteristics. As a minimum, receiving inspection and tests shall include verification, without disassembly of the article, of characteristics and design criteria that have not been source inspected by the contractor.
  - (4) Disassembly is accomplished for more detailed verification of specified requirements.
  - (5) Identification and data retrieval requirements have been met and maintained on serialized or lot controlled articles as required by design engineering, required data and records are

complete and accurate, and articles and materials can be related directly to applicable procurement source records.

- (6) Applicable inspection and test equipment and tech documents are available at appropriate place(s).
- (7) Contractor/vendor records for articles and materials having definite characteristics of quality degradation or drift with age and/or use indicate data and test time or cycle at which useful life was initiated, life or cycles used, and data and test time cycle when useful life will be expended. Records shall be maintained and updated if life or cycle occurs during receiving inspection functions. The receiving inspection control system shall ensure articles and materials (when required) indicate evidence of initiation of useful life, life or cycles used, and data and test time or cycle at which useful life will be expended.
- (8) Chemical analysis and physical tests, when required by specification or contract/purchase order are performed on test specimens submitted with purchased articles and materials.
- (9) Chemical analysis and physical tests are conducted (if applicable) as required by established inspection plans and sampling inspections and in accordance with MIL-STD-105 except when procurement document or appropriate organizational element directs otherwise.
- (10) Inspection status of articles and materials is maintained during receiving inspection and test operations. This shall include physical separation and identification of articles and materials in accordance with the following categories:
  - (a) Items waiting on inspection and/or test results.
  - (b) Conforming items.
  - (c) Nonconforming items.

- (11) Articles and materials and accompanying records for Space Shuttle flight hardware, critical Ground Support Equipment (GSE), and other hardware when specifically required, clearly indicate conformance (acceptance) or nonconformance status prior to release from receiving inspection and test.
  - (12) Articles and materials to be released are adequately controlled and protected for subsequent handling, storage, or use.
  - (13) The Acceptance Data Package (ADP) is controlled and maintained in accordance with GOP 6-6.
- b. Receiving inspection and test records shall be maintained for articles and materials and shall contain, as a minimum, the date of receipt, accomplishment of applicable requirements of paragraph a, results of inspections and tests, inspection and test procedures utilized, and disposition of articles and materials. Records shall include copies of pertinent procurement source documents received or evidence of the type and location of documents received.
- c. Inspection responsibilities may be delegated from one organizational element to another when due to program requirements direct shipment is authorized to a using organization and where both organizations agree to the delegation. Provisions of this policy shall apply in the same manner and with the same force and effectiveness as they applied to the former organization inspection and test functions.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 4-9**

**SUBJECT: FINAL ACCEPTANCE OF KSC PROCUREMENTS**

1. PURPOSE

This policy defines responsibilities and provides guidelines for using Material Instruction and Receiving Report, DD Form 250, to document, inspect, and accept NASA procurements at KSC. The procedure also covers the use of the Test Traveler system, KSC Form 2-66, for those procurements that require testing before final acceptance.

2. APPLICABILITY AND SCOPE

This policy applies to all KSC civil service and contractor organizations that are involved in the inspection, testing, and acceptance of Government procurements. Contractor involvement is restricted to the extent specified in their individual contracts. DD Form 250 is the official inspection and acceptance document for materials, supplies, equipment, and services. Form 2-66 is a KSC Test Traveler document that supports the DD Form 250 document when testing is required before final acceptance.

3. DEFINITIONS

- a. DD Form 250: A material receiving and inspection form used Government wide at destination to indicate receipt, acceptance, and inspection status of material, supplies, equipment, and services.
- b. KSC Form 2-66 (Test Traveler): A form used at KSC as supporting documentation for a signed DD Form 250, to signify that required testing took place before Government acceptance. Provides for certification of test results by the KSC technical representative, and concurrence by the cognizant quality surveillance representative. The Test Traveler stays with an article and indicates delivery and receipt of the article at a KSC support laboratory or functional test facility where the pre-acceptance tests are performed.
- c. Functional Test: A test performed to demonstrate an item operates as specified. When used to determine contract compliance, the test is conducted in the manner specified by the contract.

- d. Verification Test: An inspection process consisting of limited nondestructive chemical, electrical, mechanical, or other physical tests.
- e. Cognizant KSC Technical Representative: The technical representative (or designee) having cognizance over the article. This is the person to be contacted for resolution of any technical problems concerning the purchased material, supplies, equipment, or services, including the recommended disposition if defects are found.
- f. Cognizant KSC Duality Surveillance Representative: The individual assigned this responsibility.
- g. Contract: For the purpose of this policy, any order or agreement (including contracts, delivery orders, and any supplements thereto) for the purchase of material, supplies, equipment, or services.

#### 4. GENERAL PROVISIONS

- a. DD Form 250 generated as a result of contracts executed by NASA will be processed through receipt, inspection, and acceptance in accordance with this policy, except as follows:
  - (1) Construction contracts
  - (2) Impressed fund purchases
  - (3) Contracts for propellants
  - (4) Contracts for ordnance
  - (5) Contracts for which the end item is a technical or scientific report
- b. Materials, supplies, equipment, and services purchased on NASA contracts will be received, inspected, tested, and accepted according to quality clauses or quality codes assigned by the Systems Assurance Division.
- c. KSC Form 2-66 (Test Traveler) is used to certify acceptance tests. The completed Test Traveler supplements the completed DD Form 250.





## SECTION 5: FABRICATION

### 5.1 GENERAL

The Reliability, Maintainability, and Quality Assurance (RM&QA) program provides for all phases of fabrication control, as applicable, for inspection during operations, processing, fabricating, cleaning, assembling, and testing.

### 5.2 INSPECTION

The extent, degree, and frequency of inspection shall be sufficient to provide continuous evaluation of work performance and physical verification of quality status. As a minimum, the following areas will be covered:

- a. Materials, parts, and subassemblies released for fabrication to ensure identification, configuration, segregation, stores control, and quality status.
- b. Government/contractor accepted materials, parts, and subassemblies.
- c. In-process, functional and operational tests, nondestructive evaluation, and fabrication and cleaning operations.
- d. Process control documents.
- e. Process equipment maintenance/certification.
- f. Process controls, quality data, personnel training, and their certification/recertification.
- g. Final shop/lab inspection and functional test, where possible, of the articles processed.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 5-1**

**SUBJECT: REQUESTS FOR SUPPORT**

1. PURPOSE

This policy sets forth basic requirements for quality assurance actions associated with requests for support prepared by Government organizations at KSC and by contractor organizations as specified in the terms of their contracts.

2. APPLICABILITY

This policy applies to all KSC and contractor organizations that request onsite support from other KSC groups or organizations.

3. DEFINITIONS

- a. Requests for Support: Internal documents that require expenditure of labor and/or materials in performance of a service by one organization for another organization.
- b. Critical Requests for Support: A request for support which, if improperly performed, could result in, or potentially result in, the loss of life, vehicle, mission, and/or cause damage to flight hardware.

4. GENERAL PROVISIONS

- a. Request for support shall contain quality assurance requirements based on criticality of work to be performed. Specific requests should be made for the inclusion of quality review, acceptance, and closure.
- b. When a Support Request (SR) is prepared and the cognizant NASA/contractor quality organization considers the criticality of work, process, or service to be such that Government inspection is required, the specific inspection criteria shall be listed on the SR. Requests which require Government inspection, but do not have inspection criteria identified shall be returned to the NASA/contractor organization that approved the request.

- c. Inspection criteria approved for Government inspection on contractor initiated SRs shall be specified in the Quality Planning Requirements Document (QPRD).
- d. When an approved request for support contains Government inspection requirements, the KSC quality assurance organization having responsibility over the contractor providing the support shall perform inspection requirements. If the inspection requirements exceed the capability of the supporting quality assurance organization, the matter should be resolved with the requester's cognizant quality organization.
- e. Each listed characteristic, for which Government inspection has been performed, shall be stamped on the request for support or accompanying inspection documents with an appropriate NASA Quality Status Stamp. The quality conformance stamp signifies a Government inspector verified the inspection criteria and certifies compliance with inspection requirements.
- f. In all cases, the quality assurance organization of the contractor providing support shall perform in-process and end item inspections in accordance with requirements in the request for support, their approved quality assurance plan, and their QPRD. If inspection requirements imposed upon the contractor providing the support exceeds the contractor capability, the problem shall be referred to the cognizant Government quality assurance organization for resolution. The quality conformance stamp of the support-providing contractor's quality assurance organization shall constitute evidence that work conforms to requirements contained in the request for support.
- g. An end item, when delivered, becomes Government property or service for the receiving organization. A contractor receiving hardware or service from another contractor shall process it as Government furnished property or service in accordance with their approved quality assurance plan. The receiving organization shall verify each inspection criteria recommended for Government inspection is stamped on the Request for Support form and/or accompanying inspection documentation with an appropriate NASA quality status stamp. Any defects, deficiencies, or problems observed or encountered shall be referred to the quality

assurance organization having surveillance  
responsibility over the organization requesting support  
for coordination and resolution.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 5-2**

**SUBJECT: FABRICATION CONTROLS**

1. PURPOSE

This policy establishes the Reliability, Maintainability, and Quality Assurance (RM&QA) activities needed to support all fabrication operations and to ensure design criteria specified in contracts are obtained and maintained throughout the life of the article.

2. APPLICABILITY

This policy applies to all KSC and contractor organizational elements to the extent specified in their contracts.

3. GENERAL PROVISIONS

Detailed procedures shall be prepared defining the following:

- a. Fabrication processes used in operations, such as:
  - (1) Metallurgical and chemical (e.g., cleaning, decontamination).
  - (2) Metal joining (e.g., welding, soldering, brazing, etc.).
  - (3) Bonding.
  - (4) Potting and molding.
  - (5) Plastic application.
  - (6) Plating and coating.
  - (7) Surface treating.
- b. Procedural methods for controlling fabrication processes, such as:
  - (1) Specifications.
  - (2) Standard process procedures.

- (3) Special process and quality verification forms.
- (4) Work documents such as test preparation sheets, work orders, and planning sheets.
- c. Training and certification/re-certification requirements for personnel performing fabrication processes.
- d. Location and identification of process equipment is permanently installed and requires certification (e.g., tube flare machines).
- e. Proper certification, validation, and maintenance of process materials/fluids/gases.

#### 4. NONDESTRUCTIVE EVALUATION

Nondestructive Evaluation (NDE) methods, such as radiography, ultrasonic testing, dye penetrant inspection, magnetic particle, and other applicable methods, shall be utilized and controlled to ensure high quality hardware. The contractor shall describe the integrated approach to NDE in the RM&QA plan, including organizational assignments, facilities, standards, and procedures. NDE standards shall be prepared considering flight hardware configurations and geometry and shall represent as naturally as possible potential variations resulting from fabrication, assembly, tests, and operations. Records/reports of NDE operations should be maintained as evidence of NDE performance.

#### 5. CONTROL OF TEMPORARY REMOVALS/INSTALLATIONS OF FLIGHT HARDWARE

- a. Organizations performing work on flight vehicles shall control and monitor articles that are to be removed and installed on the flight vehicle, including shipping and handling protective materials and/or covers.
- b. Temporary removal and installation of the flight articles shall be handled in a special manner. This should include:
  - (1) A distinct identification.
  - (2) A single log or set of logs which includes a master log for each flight vehicle shall be

maintained for the temporary removal/installation thereon.

(3) The log(s) shall be initiated upon introduction of the first temporary installation/removal and be maintained throughout the life of the flight vehicle.

c. Procedures to implement/control these requirements should be developed.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 5-3**

**SUBJECT: KSC SPACE SHUTTLE TOOL CONTROL PROGRAM**

1. PURPOSE

This policy defines responsibilities and provides guidelines for the implementation and maintenance of an effective Space Shuttle Tool Control Program at the Kennedy Space Center.

2. APPLICABILITY AND SCOPE

This policy applies to all KSC civil service and contractor organizations with design, procurement, and operational responsibilities for the use and control of tools/tool kits in support of Space Shuttle flight hardware and Ground Support Equipment (GSE) processing activities. Contractor involvement is restricted to the extent specified in their individual contracts.

KSC policy is in line with the NASA policy which mandates a formal tool control program and operational standards be in place and maintained over tools/tool kits used in association with Space Shuttle flight/GSE processing activities. The formal tool control program is based on the guidelines of paragraph 4.

3. DEFINITIONS

- a. Ground Support Equipment (GSE): Equipment used in ground operations to store, transport, handle, monitor, test, checkout, service, communicate with and control aircraft, launch vehicles, payloads, and spacecraft.
- b. Tools/Tool Kits: Standard (common) handtools and special tools. Special tools include equipment and manufacturing aids that are of a unique nature that limits their use to the production or manufacture of particular supplies or parts.

4. TOOL CONTROL PROGRAM GUIDELINES

- a. Primary responsibility for tool control shall be delegated to the individual using the tool.
- b. Supervisors shall be responsible for ensuring tool users are aware of all tool control requirements.



- c. Tool control shall be in effect for all KSC controlled work areas in which flight hardware will be processed. Site specific tool information is in accordance with their respective procedures.
- d. For facilities/institutional O&M, tools may be introduced to a flight element processing area on a case-by-case basis, contingent upon specific authorization by NASA and/or contractor management.
- e. For those instances where non-KSC personnel and Space Shuttle Program (SSP) customers are working on flight hardware/GSE, the contractor responsible for the area shall ensure a tool control procedure, complying with these guidelines, is utilized by those individuals.
- f. All tools shall be individually identifiable from other like items and traceable to their assigned storage location and user.
- g. Users shall maintain tools and containers at the appropriate cleanliness level.
- h. Tool storage containers shall be organized to facilitate an expeditious inventory and inspections.
- i. Supervision of organizations under tool control shall ensure the accomplishment of a 100 percent inventory at the beginning and end of each shift.
- j. Tools shall be acquired, certified, and assigned to organizational elements.
- k. Tools shall not be transferred or loaned from one element/individual to another without formal documentation.
- l. Tools shall meet identified specifications (as determined by appropriate user).
- m. Users shall minimize to the greatest extent practical, the number of tools taken into a flight element.
- n. Tools shall be transported in an approved container.
- o. Where possible, provisions shall be made to allow for tethering of the tool(s) before usage.

- p. Individual contractors may have their own tool control program; however, they must meet these guidelines.
- q. KSC Space Flight Operations Contract (SFOC) support operations will not be required to implement the above program, but rather will:
  - (1) Have site manager/operations, safety and quality personnel continue to work the administrative and operational controls to maintain records for:
    - (a) Housekeeping Discipline
    - (b) Safe Operations - Monitoring and Enforcement
    - (c) Tethering Requirements
  - (2) Continue practice of having facility "walkdowns" daily, weekly, etc., with Safety and Quality Assurance participation, to preclude Foreign Object Damage (FOD).
  - (3) Not require support operations personnel to carry documentation (tool inventory, etc.) and daily verification of their tool complement.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 5-4**

**SUBJECT: KSC FOREIGN OBJECT CONTROL PROGRAM**

1. PURPOSE AND SCOPE

This program supplements the Safety and Quality Assurance plans at the John F. Kennedy Space Center (KSC) to ensure the planning and assigned responsibilities are in effect for preventing Foreign Object Damage (FOD) to the Space Shuttle, Space Station, Expendable Launch Vehicles, Payloads, training aircraft, transient aircraft, flight operational support equipment and ground support equipment. This program specifies and establishes Foreign Object and Debris policies and procedures required during launch and landing operations, and vehicle and payload processing and maintenance activities at the designated areas of KSC and offsite landing facilities under KSC responsibility.

2. APPLICABILITY

The provisions of this plan and the associated policies apply to personnel who work in or visit the designated processing, pre-launch, launch, and landing controlled areas and/or facilities.

3. DEFINITIONS/FUNCTIONS

- a. Foreign Object Damage (FOD): Damage to, or malfunction of, a launch vehicle or payload caused by any foreign object that is alien to flight systems. FOD may cause material damage or it may make the system or equipment inoperable, unsafe or less efficient. Some examples of FOD are ingestion of loose hardware by an engine, flight controls jammed by hardware or tools, tires cut by debris on the ramp, taxiway, or runway.
- b. Foreign Object Control Manager: An individual appointed from the Safety, Health and Independent Assessment Directorate to direct, monitor, and enforce the provisions of the Foreign Object Control Program for the KSC.
- c. Foreign Object Control Monitor: An individual appointed to monitor and enforce the provisions of the

Foreign Object Control Program within a specific area of responsibility or facility. The individual also conducts and documents the results of his/her foreign object surveillance.

4. GENERAL PROVISIONS

The overall objective of this program is to provide for walkdowns, sweeping, visual inspections, and safety assessments as stipulated by various work authorizing documents for the processing of the Space Shuttle, Expendable Launch Vehicles, Space Station, Payloads, training aircraft, and transient aircraft. FOD walkdowns, sweeping, visual inspections, and safety assessments are applicable to flight hardware; ground processing, launch, and landing facilities; flight operational support equipment; and ground support equipment.

## SECTION 6: INSPECTION AND TEST

### 6.1 GENERAL

The Reliability, Maintainability and Quality Assurance (RM&QA) program provides for participation by RM&QA personnel in all phases of inspection and test efforts and evaluations. Planning functions preceding inspections and test shall be performed to assure work authorizing documents are reviewed and appropriate requirements incorporated. Required inspections shall be performed with acceptance/rejection traceable to the individual responsible for accomplishing the task. Deviations, changes, and nonconformances will be properly documented. There shall be a program established for walkthrough/shakedown inspections, which may be in conjunction with contractor(s) programs. On construction operations, the intent of this section's inspection and test requirements are to provide the construction management organization with the requisite guidelines to assure the construction contractor complies with contract requirements, namely, the contract, contract specifications, drawings, the construction RM&QA Plan, and other contractual referenced documents.

### 6.2 RECORDS

Records and data sufficient in detail and extent shall be maintained for complete verification and evaluation of inspection and test operations.

### 6.3 PERSONNEL

Systematic techniques may be developed to designate certain trained and qualified contractor personnel to represent RM&QA in the performance of selected inspection functions, in addition to regular functions, to the extent it is economically advantageous and as specified in the contract.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 6-1**

**SUBJECT: MANDATORY INSPECTIONS**

1. PURPOSE

This policy establishes uniform requirements for identifying mandatory characteristics, selecting government mandatory inspection points, implementing inspections, and documenting results at KSC. Mandatory inspection should be required for high-risk work that effects safety, mission success, and major schedule and cost.

2. APPLICABILITY

This policy applies to all organizations that perform quality assurance functions and to those organizations responsible for identifying mandatory characteristics. It covers processing and modifications of flight hardware, facility equipment, and support equipment under the cognizance of KSC. It also governs KSC designed and procured hardware and software during the phases of fabrication, modification, and operation. The provisions of this policy shall apply to the quality assurance functions performed under letters of delegation from other NASA Centers unless specifically prohibited by letters of delegation. Where conflicts occur between this policy and letters of delegation, the letters of delegation shall take precedence. To the extent practicable, provisions of this policy shall be included in delegations issued to other government agencies.

3. DEFINITIONS

For the purpose of this policy, the following definitions apply:

- a. Quality Assurance: A planned and systematic pattern of all actions necessary to provide adequate confidence that the end-item will meet all specified requirements.
- b. Quality Assurance Program: A general term used to describe management of quality assurance and inspection operations. It includes quality assurance and inspection functions, technical direction and

monitoring of contractor quality assurance and inspection functions, quality assurance and inspection functions delegated to KSC or by KSC to other government organizations, and contractor quality assurance and inspections functions. The objective of a quality assurance program is to assure compliance with organizational, contractual, and delegated quality requirements.

NOTE: Any directive that alters terms or conditions of a contract or delegation shall be provided through appropriate contract administration channels.

- c. Quality Assurance Organization (QAO): An element organizationally responsible for quality assurance functions.
- d. Characteristics: Any dimensional, visual, functional, mechanical, electrical, chemical, physical, or material feature or property, and any control element or parameter which describes and establishes design, fabrication, and operating requirements of an article or material.
- e. Critical Characteristic: A characteristic of such significance that if defective or inadequately accomplished would cause personnel injury, loss of vehicle, or loss of mission.
- f. Major Characteristics: A characteristic of such significance that if defective or inadequately accomplished would prevent hardware from performing intended function and could cause severe delays in achievement of operational goals.
- g. Minor Characteristics: Characteristics which would not, individually, result in injury to personnel, damage to hardware, or operational problems. When considered cumulatively, however, these characteristics may become critical or major.
- h. Mandatory Characteristics: A characteristic consisting of critical, major, or cumulative minor characteristics which, if defective or inadequately accomplished, could result in hazardous or unsafe conditions, loss of vehicle or mission, or other unacceptable operations or test condition.

- i. Mandatory Inspection Point (MIP): A specific step, sequence, or time in an operation where mandatory characteristics must be verified by the Quality Assurance Organization (QAO).

NOTE: More than one Mandatory Inspection Point may be required to adequately inspect a mandatory characteristic; conversely, several mandatory characteristics may be inspected at one Mandatory Inspection Point.

- j. QPRD: The Quality Planning Requirements Document (QPRD) is a controlled plan establishing the guidelines to be used by contractor Quality Engineering or Systems Engineering for implementing the Quality Assurance Verification Program imposed upon processing operations.
- k. Witness: To observe a process or operation as it is being accomplished (in process) and to verify proper accomplishment.
- l. Verify: To confirm accomplishment of an operation, by inspecting the completed operation.
- m. Area Surveillance: To observe an operation and maintenance work area for general housekeeping, Foreign Object Debris (FOD), work in progress, and to validate compliance with approved practices and procedures.
- n. Sampling Surveillance: To randomly observe and assure work processes and products verified by individuals working in a surveillance environment.

#### 4. GENERAL PROVISIONS

- a. Minimum sets of quality planning requirements are to be used by all KSC onsite contractors involved in surveillance. These ground rules assure the contractor Quality Assurance (QA) organization inspects Operations and Maintenance Requirements Specification (OMRS) derived from Critical Items List (CIL) and Hazard Report acceptance rationale as well as those activities that involve significant risk to the efficiency or effectiveness of processing.



- b. The CIL is a compilation of items that will impact life or mission should a failure occur. The items compiled in the CIL are categorized according to their criticality using the following codes:

<u>CRITICALITY</u>	<u>POTENTIAL EFFECT OF FAILURE</u>
1	Single failure which could result in loss of life or vehicle.
1R	Redundant hardware item(s), all of which if failed, could cause loss of life or vehicle.
1S (GSE only)	A single failure in a safety or hazard monitoring system that could cause the system to fail to detect, combat, or operate when needed during the existence of a hazardous condition and could result in loss of life or vehicle.
2 (flight only)	Single failure which could result in loss of mission.
2 (GSE)	A single failure which could result in loss (damage) of a vehicle system.
2R (flight only)	Redundant hardware item(s), all of which if failed, could cause loss of mission.
3	All others.

- c. The selection of inspection points will be per the requirements herein and detailed in each contractor QPRD. Additionally, in the process and selection of Mandatory Inspection Points, full utilization shall be made of inspection requirements, information, and data obtained from the following sources: As the program matures, changes in these ground rules may be necessary. Change request rationale will be a part of the change request proposal. Approved changes and rationale will be recorded on a change page in the appropriate QPRD.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 6-2**

**SUBJECT: INTEGRITY CONTROL**

1. PURPOSE

This policy establishes requirements for implementation of a formalized integrity control system at KSC.

2. APPLICABILITY

This policy applies to all KSC organizations and contractors under KSC cognizance to the extent specified in their contract. Normally, the hardware/software to be placed under Integrity Control is identified by the organization responsible for hardware/software. This policy does not apply when performing work under letters of delegations from other Centers.

3. DEFINITIONS

Integrity Control: A formalized system established to ensure only authorized changes, modifications, and entries are made to hardware or software.

4. GENERAL PROVISIONS

- a. Procurement requests, work statements and resultant contracts shall contain requirements for integrity control systems, which are appropriate for the particular procurements and consistent with this policy.
- b. Mission-essential hardware/software shall be identified, placed under integrity control, and sealed in such a manner that unauthorized entry into the equipment is readily detectable during those periods when integrity control is in effect.
- c. Integrity Placards, KSC form 6-31 for outside use and KSC Form 2-127 for inside use shall be affixed, where appropriate, on identified mission-essential Ground Support Equipment (GSE) hardware/software enclosures to indicate equipment is under integrity control.

- d. Seals or sealants shall be affixed to hardware/software at places; such as, locks, covers, access openings, vents, ports torqued hardware, mated surfaces of electrical and mechanical devices, and over nonoperating or adjustable controls, as required to ensure positive detection of entry into the equipment. Seals, when affixed, shall be clearly stamped with a quality acceptance/conformance stamp. Integrity sealants, whose procurement issuance, handling, and application are rigidly controlled by quality organizations, do not require the Stamp. Metal B-Nut sealers may be used in appropriate situations with approval of the cognizant design and/or operations and maintenance organization.
- e. Records of entry into integrity control hardware/software shall be established and maintained. An Entry Control Log (KSC Form 4-187) may be used for this purpose. This record shall contain, as a minimum, the following information:
  - (1) Entry date.
  - (2) Name/identification of hardware entered.
  - (3) Authorizing document/reason for entry.
  - (4) Name/stamp of person entering.
  - (5) Quality conformance stamp of the inspector witnessing the entry.
  - (6) Quality conformance stamp of the inspector authorizing closure.
  - (7) Date resealed.
- f. Hardware/software under integrity control shall be entered into only as required by an approved Work Authorization Document (WAD). As a minimum, the WAD should include a callout of component find numbers for components to be opened, closed, or removed. During an emergency or by approval of KSC/Contractor Quality management action, entry may be made prior to initiation of a work authorization, providing facts are documented immediately.

- g. Work on integrity controlled hardware/software shall be monitored by the cognizant quality assurance organization.
- h. Surveillance checklists and area inspections shall include checks for broken integrity seals. Detection of a broken seal during the period of integrity control shall result in:
  - (1) Initiation of a Discrepancy Report (DR), KSC Form 2-151A, or other appropriate form.
  - (2) Appropriate tagging to indicate questionable status of hardware (GOP 7-2).
  - (3) Prompt notification of violation to cognizant KSC and contractor quality organizations.
- i. Reinspection and retest shall be accomplished to the extent necessary to revalidate the integrity of violated equipment. Complete retesting is not required provided sufficient rationale exists and is documented on the DR to indicate previous tests have not been invalidated.
- j. Torque sealants and seals shall be furnished by KSC and issued in accordance with KHB 4000.1. The placard and seals shall be furnished in accordance with KMI 1420.1. Seals and sealants approved for use are:
  - (1) Ground Support Equipment: NSN 8030-779-4700 Semi liquid white one component compound EC-1252 supplied 3M.
  - (2) Flight Hardware: Sealant materials shall be approved by the cognizant design organization.
  - (3) External Tank: No FSN. Torque Seal (blue-white), Specification number F900.

Use of seals or sealants in addition to those listed or specified in contract specifications require written approval of the SH&IA Director.
- k. Elements of the integrity control system and methods for monitoring shall be detailed in organizational procedures. Where integrity control is required, the contractor's reliability and quality assurance plan

shall be required to document the integrity control system and establish detailed implementing procedures.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 6-3**

**SUBJECT: INSPECTION PLANNING**

1. PURPOSE

This policy establishes the basic Quality Assurance (QA) requirements for inspection planning at KSC.

2. APPLICABILITY

- a. This policy applies to KSC organizational elements performing QA functions and to organizations responsible for inspection planning.
- b. Provisions of this policy are applicable to the following:
  - (1) Contracts involving QA and inspection functions.
  - (2) Processing and modification of flight hardware and associated Ground Support Equipment (GSE) under KSC cognizance.
  - (3) KSC designed and procured equipment during the phases of fabrication, modification, operation, and maintenance activities.
  - (4) QA functions performed under letter (s) of delegation from other NASA Centers.
  - (5) Letter(s) of delegation (to extent practicable) issued to other Government agencies.

NOTE: Where a conflict occurs between this policy and letter(s) of delegation, the letter(s) shall take precedence.

- c. Inspection planning requirements will be listed in an implementing document, i.e., "Quality, Planning Requirements Document (QPRD)."

### 3. DEFINITIONS

- a. Work Authorization Document: Any document authorizing or controlling work tasks, including Operations and Maintenance Instructions (OMIs) and Problem Reports (PRs).
- b. Quality Assurance Organization (QAO): A KSC element organizationally responsible for quality assurance functions.
- c. Characteristics: Any dimensional, visual, functional, mechanical, electrical, chemical, physical, or material feature or property; any control element or parameter which describes and establishes the design, fabrication, and operating requirements of an article or material.
- d. Critical Characteristic/Process: A characteristic/process of such significance that if defective or inadequately accomplished, would cause personnel injury/death, loss of vehicle, mission, and/or cause damage to flight hardware.
- e. Mandatory Characteristics: A characteristic consisting of critical, major, or cumulative minor characteristics which, if defective or inadequately accomplished, could result in hazardous or unsafe conditions, loss of vehicle or mission, or other unacceptable operations/test condition.
- f. Designees for Verification (DV): Certain trained and qualified personnel authorized to perform inspection of selected noncritical characteristics which may be reinspected later in the work flow.
- g. Mandatory Inspection Point (MIP): A specific step, sequence, or time in an operation where mandatory characteristics must be verified by the NASA QAO.

NOTE: More than one mandatory inspection point may be required to adequately inspect a mandatory characteristic; conversely, several mandatory characteristics may be inspected at one mandatory inspection point.

- h. Designated Verification Point (DVP): A predetermined step in an operation at which the Designee for

Verification (DV) will verify a selected function, action, task, or event for quality assurance.

- i. Designated Inspection Point (DIP): A specific step, sequence, or time in an operation where a designated characteristic(s) must be verified by contractor quality inspection personnel.
- j. Witness: To observe a process or operation as it is being accomplished (in process) and to verify proper accomplishment.
- k. Verify: To confirm the accomplishment of an operation by inspecting the completed operation.

4. GENERAL PROVISIONS

Inspection planning functions shall be implemented which provide for:

- a. Orderly and timely inspection through all work phases including fabrication, construction management, testing, modification, and operations and maintenance.
- b. Coordination and sequencing of inspections conducted at successive levels of work phases to ensure satisfactory articles and materials and to minimize unnecessary testing.
- c. Calibration of inspection and test equipment.
- d. Coordination of inspections conducted by contractor quality personnel, quality assurance designees, and the designated Government quality representative.
- e. Use of hardware characteristics, which have been identified, based on design and end use criticality consideration.



**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 6-4**

**SUBJECT: QUALITY ASSURANCE DESIGNEES**

1. PURPOSE

This policy provides for the designation of certain contractors, engineering, test, and operations personnel as quality assurance designees to perform specified quality assurance functions.

2. APPLICABILITY

This policy applies to all KSC organizations having quality assurance functions and to the selection, training, certification, and monitoring of contractor designees for verification, and shall be included in contracts, which specify or permit the use of designees for verification.

3. DEFINITIONS

- a. Critical Characteristic/Process: A characteristic/process of such significance that if defective or inadequately accomplished would cause personnel death/injury, loss of vehicle, or loss of mission, and/or damage to flight hardware.
- b. Mandatory Characteristics: A characteristic consisting of critical, major, or cumulative minor characteristics which, if defective or inadequately accomplished, could result in hazardous or unsafe conditions, loss of vehicle or mission, or other unacceptable operations/test conditions.
- c. Mandatory Inspection Point (MIP): A specific step, sequence, or time in an operation where mandatory characteristics must be verified by the Quality Surveillance Organization.

NOTE: More than one mandatory inspection point may be required to adequately inspect a mandatory characteristic; conversely, several mandatory characteristics may be inspected at one mandatory inspection point.

- d. Designees for Verification (DV): Certain trained and qualified contractor personnel authorized to perform inspection of selected noncritical characteristics which may be reinspected later in the work flow.
- e. Designated Verification Point (DVP): A predetermined step in an operation at which the Designee for Verification will verify a selected function, action, task or event for quality assurance.
- f. Designated Inspection Point (DIP): A specific step, sequence, or time in an operation where a designated characteristic(s) must be verified by contractor quality inspection personnel.
- g. Witness: To observe a process or operation being accomplished (in process) and to verify proper accomplishment.
- h. Verify: To confirm the accomplishment of an operation by inspecting the completed operation.

#### 4. GENERAL PROVISIONS

- a. Certain personnel from engineering, test, and operational organizations may be designated to represent quality assurance organizations in the performance of selected inspection functions to the extent it is economically advantageous. Designees for Verification shall be supervisory or lead specialists unless otherwise authorized in writing by the organization's Quality Manager/Chief documenting the reason for exception and citing the individual's qualification(s) to perform the assigned function(s). The quality functions of DVs shall be performed in conjunction with their regular duties.
- b. Personnel selected to serve as DVs shall be trained and qualified for the specific quality functions that they are to perform. Training, qualification, and certification requirements for designees shall be documented, and each DV shall be issued a letter/certificate/card attesting to the successful completion of these training requirements.
- c. The chief of the cognizant Government quality assurance organization shall approve and monitor the system established for the appointment of designees for

verification, and shall approve the training and certification requirements for DVs.

- d. Quality assurance DV's shall be issued inspection stamps distinctly different from regular inspection stamps, which shall provide traceability of inspection operations to the responsible individual. These stamps shall be subject to the same issuance and use controls as quality assurance inspection status stamps.
- e. Selected inspection and test functions to be performed by DVs shall exclude those processes, inspections, and tests which are considered critical or cases where reinspection cannot be readily accomplished due to further assembly or installation of hardware, or by final inspections/tests.
- f. The cognizant quality assurance organization shall establish standards for acceptable performance and provide for the review of the work performed by designees for verification. Failure to comply with these standards of performance shall result in the immediate revocation of the quality designation of the individual involved.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 6-5**

**SUBJECT: INSPECTION/TEST PERFORMANCE AND RECORDS**

1. PURPOSE

This policy establishes basic quality assurance requirements for inspection/test performance and records at KSC.

2. APPLICABILITY

This policy applies to all organizations responsible for quality assurance functions and covers processing and modifications of flight hardware/software, Ground Support Equipment (GSE), and support equipment/facilities under cognizance of KSC. It also governs KSC designed and procured equipment during the phases of fabrication, processing, and modification activities. Provisions of this policy shall apply to quality assurance functions performed under letters of delegation from other NASA Centers. Where conflicts occur between this policy and letters of delegation, letters of delegation shall take precedence. To the extent practicable, provisions of this policy shall be included in delegations issued to other Government agencies.

3. DEFINITIONS

For the purpose of this policy, the following definitions apply:

- a. Quality Assurance: A planned and systematic pattern of all actions necessary to provide adequate confidence that the end item will meet all specified requirements. It includes quality assurance and inspection functions, technical direction and monitoring of contractor quality assurance and inspection functions, quality assurance and inspection functions delegated to KSC, or by KSC to other Government organizations and contractor quality assurance and inspection functions. The objective of quality assurance is to assure compliance with organizational, contractual, and/or delegated quality requirements.
- b. Quality Assurance Organization (QAO): An element organizationally responsible for quality assurance functions.

- c. Characteristic: Any dimensional, visual, functional, mechanical, electrical, chemical, physical, or material feature or property; any control element or parameter which describes and establishes design, fabrication, and operating requirements of an article or material.
- d. Critical Characteristic/Process: A characteristic/process of such significance that if defective or inadequately accomplished would cause personnel injury, loss of vehicle, or loss of mission.
- e. Major Characteristic: A characteristic of such significance that if defective or inadequately accomplished would prevent hardware/software from performing their intended function and could cause severe delays in achievement of operational goals.
- f. Minor Characteristic: Characteristics which would not, individually, result in injury to personnel, damage to hardware/software, or operational problems. When considered cumulatively, however, these characteristics may become critical or major.
- g. Mandatory Characteristics: Characteristics consisting of critical, major or cumulative minor characteristics which, if defective or inadequately accomplished, could result in hazardous or unsafe conditions, loss of vehicle mission, or other unacceptable operations/test condition.
- h. Mandatory Inspection Point (MIP): A specific step, sequence, or time in an operation where mandatory characteristic(s) must be verified by the Quality Assurance Organization.

NOTE: More than one Mandatory inspection Point may be required to adequately inspect a mandatory characteristic; conversely, several mandatory characteristics may be inspected at one Mandatory Inspection Point.

- i. Surveillance Inspection Points (SIP): A square stamp used real time to identify certain tasks, operations, or processes on future work steps that NASA Quality Personnel must verify.

- j. Witness: To observe a process or operation being accomplished (in process) and to verify proper accomplishment.
- k. Verify: To confirm the accomplishment of an operation by inspecting completed operation.
- l. Work Authorization Document: Any document which authorizes controls work tasks, including Operations and Maintenance instructions (OMIs) and Problem Reports (PRs).
- m. Designees for Verification (DVs): Certain trained and qualified personnel authorized to perform inspection of selected noncritical characteristics which may be reinspected later in the work flow.
- n. Designated Verification Point (DVP): A predetermined step in an operation at which the DV (Government or Contractor) will verify a selected function, action, task, or event for quality assurance.
- o. Designated Inspection Point (DIP): A specific step, sequence, or time in an operation where a designated characteristic(s) must be verified by contractor quality inspection personnel.

#### 4. GENERAL PROVISIONS

- a. Contractor quality personnel, designees for verification, and the designated Government quality assurance representative shall be properly notified prior to start of an operation or inspection/testing, as applicable.
- b. Preplanned contractor inspection points in operations and maintenance instructions or other work documents shall be verified, as applicable. Appropriate contractor or Government quality personnel shall verify all mandatory characteristics unless waived by authority which established them. All Government mandatory inspection points shall be performed in accordance with GOP 6-1.
- c. Each inspection and, to the extent practicable, each test operation and assembly operation shall be traceable to the individual responsible for accomplishment.

- d. Articles shall be inspected and tested in accordance with approved documents available in the inspection/test area.
- e. Controls shall be established and implemented to determine the need for reinspection and retest, at any stage of work operations, after accomplishment of corrective and/or preventive action procedures when:
  - (1) The article or material does not meet specification requirements.
  - (2) The inspection or test performed is not in accordance with test specifications or inspection and test procedures.
  - (3) An equipment malfunction occurs.
  - (4) The modifications, repairs, replacement, or rework of the article or material occur after the start of inspection or testing.
  - (5) The article or material is subject to drift or degradation during storage or handling.
  - (6) Specified by a Material Review Board (MRB), retest shall be limited to consideration of the remaining useful life and operating time for qualification.

NOTE: Reinspection and retest planning shall be developed, processed, and approved in accordance with GOP 6-3.

- f. Nonconformances discovered prior to start or during and after testing shall be documented.
- g. A system shall be established and implemented for controlling and monitoring articles on flight vehicles which are to be temporarily installed and removed, including shipping and handling protective materials.
- h. Records and data generated shall be appropriate for particular type, scope, and importance of inspection or test operation performed and in sufficient detail and extent to provide for complete verification and evaluation of operations and objectives. Records shall disclose the status of articles and materials and evidence of inspections and tests (or other

surveillance actions) performed, including dates.  
Records and data generated shall be maintained on all  
inspections and tests performed.



**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 6-6**

**SUBJECT: ACCEPTANCE DATA PACKAGES**

1. PURPOSE

This policy sets forth basic requirements for quality assurance controls required in receiving and maintaining Acceptance Data Packages (ADPs) at KSC.

2. APPLICABILITY

This policy applies to all KSC organizational elements and contractors (to the extent specified in their contracts) who are involved in operations having any effect on data required in ADPs, except for facilities, system, and equipment turnover between design engineering and the responsible operating and maintenance organizations.

3. DEFINITIONS

Acceptance Data Package: The means for accumulating specific data in a single package, it is designed to provide a complete status of article or facility at the point of delivery and to provide information pertinent to the using organization which enables continuation of required activities. Applicable data items required for both flight hardware and Ground Support Equipment include waiver/deviations, shortages, open work, deferred operations, serialized indenture parts list, operating time/cycle, age sensitive/time action items, nonstandard calibration data, repair limitations, pressure vessel data, and pyrotechnic data. Applicable data items required only for Flight Hardware is temporary installations and office records (engine only). In addition to the above items, all ADPs shall contain a copy of shipping document (DD Form 250), a title page, and index page, and a notes/comments section (as applicable).

4. GENERAL PROVISIONS

- a. ADP records shall be maintained in a total, current, and accurate manner from point of article delivery until KSC transfers article custody. Appropriate entries will be made for each required data item of ADP as the article flows through various operations required at KSC; such as, acceptance, checkout, storage, installation, repair, and refurbishment. Quality assurance validation requirements during maintenance of the ADP shall be established.
- b. A detailed check shall be made during receiving inspection operations of the material inspections, and receiving report, (DD Form 250), or other documents relating to transfer of accountability (example: DD Form 1149, requisition and invoice shipping document) to assure it matches with the ADP concerning part and serial numbers of items shipped (including loose equipment) and all shortages/open work items are listed. Also verification shall be made to assure all software items are included. Any discrepancies or shortages, including an incomplete ADP, shall be documented on problem reports for corrective action.
- c. Detailed procedures shall be written to implement this policy in affected organizational elements. Procedures shall assign specific quality assurance validation responsibilities for applicable data.

SECTION 7: NONCONFORMING ARTICLES AND MATERIALS

7.1 GENERAL

The Reliability and Quality Assurance (R&QA) program provides for participation, by R&QA personnel, in all phases of nonconforming articles and materials control activities. A controlled closed loop system for identification, documentation, and control of nonconforming hardware shall be established and implemented. Nonconforming hardware shall be identified immediately upon noting a discrepancy and/or when hardware is removed.

7.2 DOCUMENTATION

The Nonconformance/Problem Reporting and Corrective Action (PRACA) system shall include recording, reporting, analyzing, correcting, verifying, and feedback of data. Records shall be maintained of all nonconformances, including dispositions.

7.3 PERSONNEL

Government personnel shall monitor contractor's Nonconformance/Reporting and Corrective Action System to ensure prompt and effective action.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 7-1**

**SUBJECT: CORRECTIVE ACTION AT OFFSITE LOCATIONS**

1. PURPOSE

This policy establishes a system for requesting corrective action by the Government agency performing the quality assurance functions (in support of KSC contracts) at offsite locations for articles determined to be nonconforming upon receipt at KSC.

2. APPLICABILITY

The provisions of this policy apply to the following activities:

- a. Documenting all nonconformances on Discrepancy Report (KSC Form 2-153) for articles found discrepant upon receipt at KSC when articles were inspected by the Government agency performing quality assurance functions in support of KSC contracts.
- b. Daily review of Discrepancy Reports (DRs) or contractor documentation for determination of the need for corrective action by the Government agency.
- c. Preparation, issuance and Followup on Nonconformance Investigation Requests (NIRs).

Material obtained from General Services Administration and Defense Supply Agency and found discrepant upon receipt shall be processed in accordance with KHB 4000.1 (as revised).

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 7-2**

**SUBJECT: NONCONFORMING ITEMS, TAGGING OF**

1. PURPOSE

This policy provides for control of, nonconforming hardware under cognizance of KSC, except in construction contracts.

2. APPLICABILITY

This policy applies to all KSC organizations except for those holding construction contracts.

3. DEFINITIONS

For the purpose of this policy, the following definitions apply:

- a. Nonconformance: A condition of any article, material or service in which one or more characteristics do not conform to requirements (includes failures, discrepancies, defects, and malfunctions).
- b. Nonconforming: An article, material, or service containing a nonconformance.
- c. Mission-essential: Indispensable to the successful completion of the mission. (GOP 6-2)

4. GENERAL PROVISIONS

- a. Nonconforming hardware shall be controlled as follows:
  - (1) Prior to removal, presence in system shall be evidenced by:
    - (a) A tag, attached at the lowest level of assembly at which it is visible, or,
    - (b) a documentation method. In systems where tagging is not desirable (e.g., in-flight crew habitat), a tagging method shall be specified exempted by the directorate/organizational operating

procedures and a documentation method will be maintained at the site.

- (2) All nonconforming hardware removed from a system shall be tagged; those that remain in a system will also be tagged unless exempted in accordance with paragraph 4a(1)(b).
- b. The tag will remain with the nonconforming article until:
  - (1) Disposition of the nonconformance has been completed, or
  - (2) The article has been returned to the cognizant NASA center (if other than KSC), or
  - (3) A failure analysis, as approved by the appropriate NASA official, has begun (GOP 7-4) and final disposition of the article has been made.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 7-3**

**SUBJECT: DEVIATION/WAIVER**

1. PURPOSE

This policy establishes the Kennedy Space Center (KSC) requirements for the requesting, processing, and approval/disapproval of Deviations and Waivers (D/Ws) to Ground Support Equipment (GSE) and facilities technical design and engineering specifications. This policy is intended to authorize the use of hardware/software that does not conform to set criteria. This policy pertains to facility systems and GSE hardware/software under the cognizance of KSC organizations and contractors to the extent specified in their contracts.

2. APPLICABILITY

This instruction applies to all KSC organization/contractors having operational, maintenance, logistics, quality assurance and/or sustaining engineering responsibility for KSC facility systems and GSE.

3. SCOPE

- a. This policy applies to D/Ws to facility systems and GSE and to support contractors who have design responsibilities for those facility systems and GSE essential to the KSC mission. This GOP is also applicable to Quality Program Requirements Document (QPRD) D/W's for KSC.
- b. This policy does not include deviations and waivers for:
  - (1) Hardware procured under a KSC contract and construction contract requirements not yet accepted by the Government.
  - (2) Technical operations procedures, which include Operations and Maintenance Instructions (OMIs), Test Preparation Sheets (TPSs), Job Cards, and other such operational procedures.

- (3) Safety Variance deviation/waiver/exemption for Safety and Fire Protection policies and requirements.
- (4) Operational and Maintenance Requirements and Specifications Document (OMRSDs).
- (5) Programmatic Critical Items List fails safe requirements.

#### 4. DEFINITIONS

a. Deviation:

A specific authorization, granted before the fact, to depart from specified requirements in contracts, technical specifications, drawings, and/or KSC policy documents.

b. Maintainability:

The quality of combined features of equipment design and installation which facilitates the accomplishment of inspection, test, checkout, servicing, repair, and overhaul necessary to meet operational objectives with a minimum of time, skill, and resources in a planned maintenance environment.

c. Quality Assurance:

A planned and systematic pattern of all actions necessary to provide adequate confidence that the end item will meet all specified requirements.

d. Reliability:

A characteristic of a system, or any element thereof, expressed as a probability that it will perform its required function under defined conditions at designated times for specified operating periods.

e. Waiver:

Granted use or acceptance of an article covering a specific mission or time period (not to exceed one year) of hardware/software which does not meet specific requirements. A waiver is given or authorized after the fact.



5. GENERAL PROVISIONS

- a. Articles/operations that do not conform to specified requirements, or changes to specified requirements, that degrade the reliability/maintainability/quality assurance of a product/service, where there is no desire to change that requirement, require a deviation to be requested before the fact or a waiver processed after the fact.
- b. Specified requirements that cannot justifiably be met shall be considered prior to the fact and be written as a deviation.
- c. Any action, design, procedure, etc., on facility systems or GSE that prevents the RM&QA intent should be considered whether it may or may not be a D/W.
- d. Requests for a D/W must be submitted on KSC Form 20-168. As a minimum requirement, in addition to describing the D/W, the articles/operations do not conform to specific requirements shall be listed on Form 20-168 in Block #11, "Description" and justification for the D/W shall be described in Block #12, "Detailed Rationale."
- e. Organizations are responsible for developing procedures to implement the provisions of this policy.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 7-4**

**SUBJECT: FAILURE ANALYSIS**

1. PURPOSE

This policy assigns responsibilities and provides methods for obtaining failure analysis of equipment under the cognizance of KSC.

2. APPLICABILITY/SCOPE

This policy covers failure analysis of Ground Support Equipment (GSE) and flight hardware, and applies to all organizational elements that request, approve, or perform failure analyses.

3. DEFINITIONS

- a. Failure: Inability of a system, subsystem, component or part to perform required functions (criteria for required function include specified limits, conditions, and duration). A part, component, subsystem or system cannot be classified as failed until subjected to a functional test or actual usage, and a determination is made that it does not perform as specified. However, an exception to this is when an article may be classified as failed because there is discernible evidence of failure that would obviously prohibit the article from performing its intended function, or there is evidence that if allowed to operate, a failure would be imminent.
- b. Failure Analysis: Physical analysis of hardware accomplished by specially trained (laboratory) personnel and is conducted outside normal repair, refurbishment, or maintenance operations for the purpose of determining failure mechanisms and failure modes of the piece that failed.
- c. Failure Mechanism: Physical process resulting in a part or equipment failure, i.e., cause of a failure.
- d. Failure mode: Physical description of the nature of the failure and operating condition of equipment at the time of failure.

- e. Laboratory Report: Description of analytical tests and results of such tests pertaining to the reported failed article.
- f. Failure Analysis Instruction: Description of special steps or restrictions which are to be followed when performing a failure analysis. This may include, but is not limited to:
  - (1) Whether or not a destructive analysis is allowed.
  - (2) Disassembly sequences.
  - (3) Functional testing or examination of like or similar non-failed hardware.

#### 4. GENERAL PROVISIONS

All requests for failure analysis of both flight hardware and ground support hardware shall be made through the Material Science Office (867-9265) or through the customer website, <http://aisdb.ksc.nasa.gov:800/>. Each article and any additional supporting paperwork (such as, the Problem Report) associated with the request should be brought to the Customer Service Office located in the O&C Building Room 1227.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 7-4-1**

**SUBJECT: FAILURE ANALYSIS-CORRECTIVE ACTION REQUESTS**

1. GENERAL

- a. All contractors and KSC organizations to request failure analysis of both flight and ground support hardware shall use the Failure Analysis Request (KSC Form 11-107).
- b. KSC Form 11-107 consists of a multicopy single sheet, with instruction for completion contained below. A completed form shall accompany each article submitted to the Malfunction Analysis Organization for failure analysis.
- c. A legible copy of the Problem Report (PR) shall accompany KSC Form 11-107. The Problem Report should include all available information that may aid in the failure analysis.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 7-5**

**SUBJECT: MATERIAL REVIEW BOARDS**

1. PURPOSE

This policy provides for establishment and operation of Material Review Boards (MRBs) under cognizance of KSC contracts on Nonconforming Articles or Services involving two situations: Nonconforming Articles prior to Government acceptance and Nonconforming Articles following Government acceptance.

2. APPLICABILITY

This policy applies to all organizations.

3. DEFINITIONS

- a. Material Review Board: Decision making team, composed of one contractor representative whose primary responsibility is design/sustaining engineering, one contractor representative whose primary responsibility is product quality, and one Government quality representative acting on behalf of KSC, whose primary responsibility is to determine or recommend disposition of nonconforming articles that cannot be returned to drawing/specification requirements.
- b. Major Nonconformance: Any nonconformance that could affect matters such as safety to facilities or individuals, reliability, durability, performance, interchangeability, weight (where weight is a significant factor) or basic design intent. Material substitution is defined as a major nonconformance.
- c. Minor Nonconformance: Any nonconformance other than major that does not reduce usability of an item for intended purpose or is a departure from established standards having no significant bearing on effective use or operation of the product or associated units.
- d. Hardware: Physical equipment, as opposed to a computer program or software; for example, mechanical, electromechanical, magnetic, electrical, or electronic devices.

- e. Software: The programs, routines, or instructions essential to the operation of computers. Some examples of software include operating systems, word processing programs, and spreadsheet programs.
- f. Firmware: Hardware components containing imbedded static logical information usable by electronic systems.
- g. Repair: Additional or unplanned manufacturing or maintenance operations performed upon an article in order to render article acceptable for use.
- h. Use-as-is: Decision to accept or otherwise use a nonconforming article without correcting the nonconformance.
- i. Government Furnished Property (GFP): Property in possession of, or acquired directly by, the Government and subsequently delivered to or otherwise made available to a contractor.
- j. Contractor Acquired Property: Property acquired or otherwise provided by the contractor for performing a contract and to subsequently be turned over to the Government.
- k. Government Property: Property owned or leased to the Government or acquired by the Government under the terms of the contract.
- l. Rework: Return of an article for further work processing or work completion in accordance with established manufacturing or maintenance procedures in order to return the article to drawing configuration.
- m. Scrap: As used in this procedure, scrap is hardware that is unfit for its intended purpose. Hardware classified as scrap by an MRB may be salvaged for use as training aids, mockups, or other uses, as long as hardware is irrevocably identified as nonconforming and processed in accordance with procedures approved by a cognizant Government property administrator.
- n. Deviation: Granted approval before the fact to use an article or perform an action that does not meet specified requirements. Requirements will normally be

defined in contracts, technical specifications, drawings, and NASA policy documents.

- o. Waiver: Granted approval after the fact to use an article or perform an action that does not meet specified requirements.
- p. Nonconformance: Condition of any article, material, or service in which one or more characteristics do not conform to requirements. This includes failures, discrepancies, defects, and malfunctions.

#### 4. BACKGROUND AND GENERAL POLICY

Material Review Boards (MRBs), as required by NASA RM&QA Policy, are used on contracts during the procurement/fabrication cycle prior to article acceptance by the Government. The MRB provides for a review and technical disposition process for nonconforming parts, materials, services, and software. When these nonconformances do not agree with KSC contracts, drawings, specifications or other pertinent requirements, the MRB process shall be used as authorized by KSC contracts in accordance with this RM&QA Handbook General Operating Policy 7-5, paragraph 5.

Once an article has been accepted by the Government, even when acquired by a contractor, it becomes Government Property with rules governing Government Property listed in Federal Acquisition Regulations (FAR) Part 45 "Government Property" and as amended by Federal Acquisition Regulation Supplement (NASA/FAR Supplement) NPG 5100.4.

In addition, it is the practice at KSC to use Review Boards including MRBs to resolve problem with nonconforming articles processed on launch and support service type contracts. For MRB activities on these types of contracts, the requirements contained in paragraph 6 of this document shall be followed. Acceptance of an article by the government is generally indicated by an authorized signature on a DD Form 250 or other acceptance form. The major differences between accepted and unaccepted contract deliverables are the parties' rights and responsibilities concerning the items (transfer of legal title and risk of loss upon acceptance, contractor's obligation to repair or replace unaccepted non-conforming items, government's obligation to pay the contract price for accepted items, etc.). The signature requirements contained in paragraph 6 are in agreement with the Federal Acquisition Regulation,

the applicable NASA Handbooks on RM&QA Policy involving Government Property Control.

5. MRB REQUIREMENTS FOR NONCONFORMING ARTICLES PRIOR TO GOVERNMENT ACCEPTANCE

- a. When MRBs are required, they must be established and authorized by contract. For each contract, one or more MRBs may be established as demanded by volume and diversity of operations.
- b. Contractor MRB members shall be approved by the Government quality representative MRB member. Pertinent technical competence and a thorough knowledge of product quality and functional requirements shall be prerequisite qualifications for all MRB members.
- c. Each MRB member may have alternates. When an MRB member, or alternate, is limited to acting upon certain types of nonconforming hardware, or nonconforming hardware from certain geographical locations, these limitations shall be noted on lists maintained by cognizant quality surveillance organization.
- d. Each MRB action shall be unanimous. When unanimous agreement cannot be reached, the request shall be forwarded to the Contracting Officer. The Contracting Officer shall consult with cognizant quality and technical personnel and then notify the contractor of appropriate classification and disposition.
- e. Each MRB member may consult with other Government/contractor personnel in forming his/her opinion; however, such consultation or advisory personnel shall have no vote in the final decision or recommendation which is made by the Board. Each member of the MRB shall review material to be dispositioned in a timely manner.
- f. It is not mandatory that three MRB members physically meet for each MRB action; however, any member in a timely manner may require the entire Board to convene in order to resolve disagreements and reach a unanimous decision.



- g. MRBs shall not become involved with troubleshooting or any other investigative effort that attempts to identify nonconforming or malfunctioning hardware/software, nor shall the MRB review hardware which can be repaired to a serviceable condition under an approved maintenance procedure.
  - h. MRBs may develop and shall approve all standard repair procedures.
  - i. MRBs may authorize the use (or delivery) of minor nonconforming articles. The Contracting Officer must authorize use (or delivery) of major nonconforming articles. If repeated similar nonconforming articles or services are recorded on a contract, the Contracting Officer should be notified if contractor performance is in question and/or equitable price adjustment is involved.
  - j. Records of all nonconforming items presented to the MRB and their disposition shall be maintained. These records shall provide an audit trail from initial nonconformance record to final disposition and shall contain, as a minimum, the following:
    - (1) MRB Case Number. A number which is unique to each MRB disposition. (If preprinted serialized forms are used, these numbers shall serve as MRB case numbers.)
    - (2) Description of each nonconformance.
    - (3) Disposition of each nonconformance.
    - (4) Reference to any waiver requests that were generated.
    - (5) Signature of all voting MRB members.
    - (6) Reference to any other supporting documentation, or other nonconformance records.
6. MRB REQUIREMENTS FOR NONCONFORMING ARTICLES AFTER GOVERNMENT ACCEPTANCE

Once the Government has accepted an article either by a contractor acquiring it for the Government, or by the Government leasing or acquiring it themselves, the property

is considered "Government Property." The following rules will apply to KSC contracts involving MRB operations:

- a. When MRBs are required, they must be established and authorized by contract. For each contract, one or more MRBs may be established as demanded by volume and diversity of operations.
- b. Contractor MRB members shall be approved by the Government quality MRB member. Pertinent technical competence and a thorough knowledge of product quality and functional requirements shall be prerequisite qualifications for all MRB members.
- c. Each MRB member may have alternates. When an MRB member, or alternate, is limited to acting upon certain types of nonconforming hardware, or nonconforming hardware for certain geographical locations, these limitations shall be noted on lists maintained by the cognizant quality surveillance organization.
- d. Each MRB action shall be unanimous. When unanimous agreement cannot be reached, the request shall be forwarded to applicable technical representatives as well as the Contracting Officer. After the decision by appropriate technical personnel, and concurrence by the Contracting Officer is made, the contractor should be so notified of the nonconformance classification and disposition.
- e. Each MRB member may consult with other Government/contractor personnel in forming his opinion; however, such consultation or advisory personnel shall have no vote in the final decision or recommendation that is made by the Board.
- f. It is not mandatory that three MRB members physically meet for each MRB action; however, any member may require the entire Board to convene in order to resolve disagreements and reach a unanimous decision.
- g. MRBs shall not become involved with troubleshooting or any other investigative effort which attempts to identify nonconforming or malfunctioning hardware/software, nor shall the MRB review hardware which can be reworked to a serviceable condition under an approved maintenance procedure.

- h. MRB's may develop and shall approve all standard repair procedures.
- i. MRBs for Government property may disposition both major/minor nonconforming articles. However, when nonconformances cause changes to contract scope or statements of work, the official correspondence to the contractor should be transmitted through, or in coordination with, the appropriate Contracting Officer.
- j. Records of all nonconforming items presented to the MRB and their disposition shall be maintained. These records shall provide an audit trail from initial nonconformance record to final disposition and shall contain, as a minimum, information listed in paragraph 5j.

7. ACTIONS PRIOR AND DURING MRB DISPOSITIONS

The actions addressed in this paragraph 7 may be taken without prior notification of the Contracting Officer as long as they do not:

- (1) constitute an assignment of additional work outside the Statement of Work
- (2) constitute a change as defined in the changes clause
- (3) constitute a basis for any increase or decrease in the total estimated contract cost, the fixed fee (if any) or the times required for contract performance
- (4) change any of the expressed terms, conditions or specifications of the contract
- (5) interfere with the contractor's rights to perform the terms and conditions of the contract
- (6) result in a decision or issuance of finding on any dispute concerning a question of fact or law arising under the contract
- (7) result in the execution of or agreement to any modification to the contract.
- (8) constitute action which is reasonably anticipated to result in a loss of government rights or available

recourse under the contract with regard to the non-conforming items.

Questions concerning the above shall be immediately resolved by contacting the Contracting Officer.

a. Prior Contractor Action. The contractor shall take the following actions prior to submission of nonconforming hardware/software to an MRB for disposition:

- (1) When hardware is first found to depart from specified requirements, it will be properly identified as nonconforming and, where possible, moved to a designated holding area to wait disposition. Where removal or movement to a holding area is impractical, marking or tagging shall be accomplished in such a manner as to assure positive identification of the nonconformance (Reference GOP 7-2).
- (2) All nonconforming hardware/software shall be reviewed for possible disposition without MRB action. This review shall be accomplished by contractor quality personnel (and engineering personnel, if desired), and the dispositions which may result are:
  - (a) Rework: Rework shall be accomplished in accordance with established manufacturing or maintenance procedures. If written procedures do not exist which return the article to a conforming condition, it shall be submitted to the MRB for disposition. Reworked items shall be processed through normal inspection/testing channels.
  - (b) Return to Supplier. This includes shipment of any nonconforming hardware/software to a preassigned destination without review by an MRB.
  - (c) Scrap. If an article is obviously unfit for use or delivery, or is determined not to be economically repairable (normally 65 percent of acquisition cost), it shall be identified and disposed of as scrap. On cost reimbursable type contracts, scrap shall be processed in accordance with Government

approved procedures for disposing of scrap. The Contracting Officer shall be consulted on fixed price contracts before material is scrapped.

- (d) Standard Repair. If a repair is possible and an applicable approved standard repair procedure is in existence, repairs may be accomplished in accordance with the approved procedure without any further MRB action. If the procedure is changed, then full MRB approval is required.
- (e) Waivers/Deviations. A waiver/deviation request may be submitted through appropriate channels for NASA approval prior to or as a result of consideration of other dispositions. Each waiver/deviation request shall be submitted with a written recommendation and proposed remedial and preventive action. This may be provided on an enclosed or referenced document.

If the article cannot be disposed of through one of the above actions, it shall be referred to as an MRB.

- b. MRB Dispositions. In determining dispositions, the Board shall: consider effect of the nonconformance upon intended use; classify nonconformance for processing on a priority basis; review records of earlier review actions affecting the same or like article or material; and consider recommendations of personnel acting in an advisory capacity. The Board shall specify on the nonconformance report document one of the following dispositions:
  - (1) Waivers/Deviations. Refer to paragraph 7a(2)(e).
  - (2) Repair. When, in the opinion of the Board, an acceptable repair is possible; repair action may be authorized. Procedures shall be established or approved by the MRB to perform this repair. Procedures shall include appropriate inspections and tests to verify acceptability of repair. Standard repair procedures, if developed, shall be in accordance with paragraph 7a(2)(d).

- (3) Use-As-Is. Nonconformance that the MRB feels is suitable for use without repair may be authorized for use-as-is. The rationale for making a use-as-is disposition shall be documented.
  - (4) Scrap. Refer to paragraph 7a(2)(c).
- c. For KSC contracts involving major nonconforming articles that have not been accepted by the Government and do not meet contract requirements, the NASA Contracting Officer approval shall be required.
- d. Only the contracting officer has the authority to modify contract requirements, including relaxing or waiving the contract's technical requirements. All recommended changes to the contract shall be submitted to the contracting officer for approval and issuance, as soon as they are identified and recommended for implementation by the government's operating/technical organization and prior to issuance of any direction to the contractor, which could be interpreted as a change to the contract.

## SECTION 8: METROLOGY/CALIBRATION

### 8.1 GENERAL

The measurement assurance resulting from a Metrology/Calibration Quality Assurance Program is vital to operations at KSC, affecting the validity of test data, the accurate determination of proper system function and the safety of personnel. Controls are necessary to ensure the proper calibration and use of test equipment and provide verification of adherence to procedures.

### 8.2 CALIBRATION

The Reliability and Quality Assurance Program provisions for metrology and calibration are incorporated as an integral part of the KSC Metrology/Calibration Program.

Compliance is ensured through contractor implementation of their Quality Assurance Plans/Procedures, which provide methods for ascertaining that calibration operations do not deviate from, established requirements, and through NASA Quality Assurance organizational implementation of NASA Quality Assurance procedures, which provide methods for documented surveillance, and evaluation of contractor performance. In addition, surveys are periodically performed on contractor and NASA Quality Assurance organizations to ensure uniformity in the application of controls, compliance to procedures, and to assess the effectiveness of the program.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 8-1**

**SUBJECT: METROLOGY/CALIBRATION**

1. PURPOSE

This policy establishes provisions for Quality Assurance personnel to perform to verify that the KSC Metrology/Calibration Program is implemented in accordance with requirements.

2. APPLICABILITY

This policy applies to all NASA Quality Assurance organizations and contractor/subcontractor Quality Assurance elements under KSC cognizance as required and provided by their respective contracts.

3. GENERAL PROVISIONS

Heads of Quality Assurance organizations are responsible for ensuring that:

- (1) Quality Assurance Surveillance personnel monitor, inspect, and audit calibration operations and test operations involving the utilization of calibrated test equipment.
- (2) KSC has a single Metrology/Calibration Program, the elements of which participates in and are coordinated through the KSC Calibration Working Group.
- (3) Elements of the KSC Metrology/Calibration Program performing calibration have a documented system that provides for the recall and noncompliance reporting of instruments requiring periodic calibration; the intervals of which are determined through the consideration of reliability, accuracy, and use factors.
- (4) Calibrations are performed in accordance with written procedures using identified standards traceable to nationally recognized standards and that calibrations are sufficiently documented to provide objective evidence of compliance.



- (5) Measurements performed during calibration operations have the results recorded/maintained, the effects of environmental conditions controlled or assessed when applicable, and data uncertainty stated if the standard is not at least four times more accurate than the specification being verified.
- (6) Calibrated instruments are uniquely identified, labeled to indicate status, sealed to ensure integrity, handled so as to retain calibration validity, and that each critical use/application is recorded to facilitate remedial actions in the event of a subsequent nonconformance determination.
- (7) Nonconformance conditions discovered during an instrument's calibration are reported to the cognizant using organization and that the using organization, or a user's Quality Engineering support group, evaluates instruments found to be significantly out-of-tolerance (more than twice the specification limit) for impact on critical work previously accomplished with the suspect instrument to determine if remedial action/rework is necessary. If the calibration interval or the nature of the operation precludes remedial actions, preventive measures will be incorporated into procedures, e.g., pre-checks, post checks.
- (8) Equipment that is uncalibrated, has an expired calibration, shows signs of misuse or is otherwise suspect is withheld from use. If not withheld from use, such occurrences are formally documented as nonconformances and the operation is not finally accepted by quality assurance personnel until the nonconforming test equipment is recalibrated and found to be within tolerances or the operation is performed again using calibrated test equipment.
- (9) Calibration personnel are properly trained/certified for metrology/calibration operations.
- (10) Discrepancies to the requirements identified above are documented, reported, have corrective actions initiated, and are tracked until completed/closed.



## SECTION 9: QUALITY STATUS STAMPS

### 9.1 GENERAL

The Reliability, Maintainability, and Quality Assurance (RM&QA) program shall include a documented system of control for NASA quality status stamps.

### 9.2 CONTROLS

The control system, including records, provides for stamp traceability and accountability to responsible individuals. Contractors shall be required to implement control(s) over quality status stamps in accordance with applicable KSC contract provisions as follows:

- a. Unissued quality status stamps are to be retained in a secured area to prevent unauthorized use.
- b. Quality status stamps that have been turned in shall not be reissued for a period of six months.
- c. Quality status stamps that have been lost shall not have the identification number reissued for a period of one year.
- d. Worn or damaged quality status stamps shall be destroyed following replacement.
- e. Audits shall be conducted periodically to assure quality status stamps are in the possession of the individual to whom assigned.
- f. Quality status stamp applications shall include records, tags, cards, and labels to indicate inspection performance and status of associated articles and materials.



SECTION 10: HANDLING, STORAGE, PRESERVATION, MARKING,  
LABELING, PACKAGING, PACKING, AND SHIPPING

The Reliability, Maintainability, and Quality Assurance (RM&QA) program provides for participation by RM&QA personnel in all phases of handling, storage, preservation, marking, labeling, packaging, packing, and shipping activities and shall include programs to ensure the following:

- a. Handling: Planning documents shall be reviewed for verification of content as follows: instructions, identification of special equipment, special covers, containers, etc.
- b. Storage: Areas for storage shall have controls for acceptance and withdrawal, limited life material, and inspection.
- c. Preservation: Items subject to deterioration, corrosion, or contamination shall be preserved in accordance with applicable KSC provisions.
- d. Packaging: Appropriate packaging materials, procedures, and instructions shall be utilized to provide protection for items during handling and storage. Special attention shall be given to items of a critical, sensitive, dangerous, or high value nature.
- e. Packing: Inspection procedures shall be performed to ensure items for packing are ready, undamaged during packing operations, and that specific requirements are met.
- f. Marking and Labeling: Item for packaging, storage, and shipping shall be marked and labeled in accordance with applicable KSC provisions.

Label - A form, placard, tag, or document (sheath of papers) that identifies the package to which it is affixed which may include enumerating details on contracts, shipping, handling, storage, preservation, etc.

- g. Shipping: Control of items prepared for shipping shall be in accordance with applicable KSC provisions.

**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 10-1**

**SUBJECT: HANDLING, STORAGE, PRESERVATION, MARKING,  
LABELING, PACKAGING, PACKING, AND SHIPPING**

1. PURPOSE

This policy provides guidelines for quality assurance personnel in establishing controls for handling, storage, preservation, marking, labeling, packaging, packing, and shipping functions.

2. APPLICABILITY

This policy applies to KSC organizational elements having quality assurance functions relative to handling, storage, preservation, marking, labeling, packaging, packing, and shipping.

3. GENERAL PROVISIONS

Reference NHG 6000.1 for detailed provisions and the following general provisions:

- a. Handling. Applicable manufacturer's handling instructions shall be adhered to and any special handling equipment required shall be used. Evidence of initial and periodic proof testing of applicable handling equipment shall be maintained. For critical or costly equipment, shock mount instrumentation should be considered for use during shipment.
- b. Storage. Storage areas shall be controlled for articles and materials not in work. Controls shall include the following:
  - (1) Controlled acceptance into and withdrawal from storage area.
  - (2) Identification of limited life material and removal of material where shelf life has expired.
  - (3) Periodic inspection of stored material, housekeeping, and records maintenance.

- (4) Systematic inspection and/or testing necessary to ensure maintenance of preservation include special environments, for articles in long term storage.
- c. Preservation. Articles and materials subject to deterioration, corrosion, or contamination through exposure to air, moisture, sunlight, or other environmental elements during storage shall be cleaned and preserved by methods ensuring practical protection consistent with life, cost, and usage. All preservation instructions contained in manufacturer(s)/KSC documents shall be accomplished.
- d. Labeling. Appropriate labeling shall be provided for packaging, storage, and shipping of articles and materials in accordance with applicable specifications. Labels shall include the following when appropriate.
  - (1) Complete article or material identification.
  - (2) Cleanliness level.
  - (3) Environmental requirements.
  - (4) Package orientation arrows.
  - (5) Caution and warning notes.
  - (6) Life expiration dates.
  - (7) Location of data package.
  - (8) Transportation data/special instructions.

Tamper proof decals or labels shall be utilized on precision cleaned articles to permit ready detection of loss of packaging integrity. Special attention shall be given to critical, clean, sensitive, dangerous, and high value articles.
- e. Packaging. Appropriate packaging material and procedures shall be utilized for protection of articles and materials after arrival (at KSC) and prior to shipping. Special attention shall be paid to critical, sensitive, dangerous, and high value articles. For critical or costly equipment, special shock mount instrumentation should be considered for use during shipment.

- f. Packing. When packing operations are required, inspection (as necessary) shall be performed to ensure articles or materials are packaged and undamaged during packing operations, and packing meets specified requirements. When reusable containers are used, they shall be inspected prior to use for completeness and suitability. For critical or costly equipment, special shock mount instrumentation should be considered for use during shipment.



**RELIABILITY, MAINTAINABILITY, AND QUALITY ASSURANCE  
GENERAL OPERATING POLICY 10-2**

**SUBJECT: AGE/LIMITED LIFE CONTROLS**

1. PURPOSE

This policy provides for R&QA control of articles and materials having definite characteristics of quality degradation or drift with age and/or limited life expectancy.

2. APPLICABILITY

This policy applies to KSC organizational elements having R&QA functions relative to age/limited life controls.

3. DEFINITIONS

- a. Limited Life Item. Any item designated as having a limited useful life regardless of whether it is a limited operating life, limited shelf life or a combination of both. This includes (where appropriate) fluids, elastomers, and polymers.
- b. Limited Operating Life Item. Any item which deteriorates with increased accumulation of operating time/cycles and thus requires periodic replacement or refurbishment to assure operating characteristics have not degraded beyond acceptable limits including consideration for total mission time/cycles and safety factor margins.
- c. Limited Shelf Life Item. Any item which deteriorates with the passage of time, thus requiring periodic replacement, refurbishment, retesting, or operation to assure operating characteristics have not degraded beyond acceptable limits. This includes installed as well as stored components.
- d. Operating Cycles. The cumulative number of times an item completes a sequence of activation and returns to normal state; e.g., a switch-on/switch-off sequence, a valve-open/valve-closed sequence, tank-pressurized/tank-depressurized, or dewar cryogenic exposure/drain.

- e. Operating Life. The maximum operating time/cycles which an item can accrue before replacement or refurbishment without risk of degradation of performance beyond acceptable limits.

#### 4. GENERAL PROVISIONS

- a. During fabrication, articles having definite characteristics of quality degradation or drift with age and/or use shall be marked to indicate date, test time/cycles critical life was initiated, and date test time/cycle useful life shall be expended. This data shall be properly recorded in logbooks.
- b. During the test, the contractor shall generate and maintain records and data of all inspections/tests performed. The records and data generated shall be appropriate for particular type, scope, and importance of the inspection or test operation performed and in sufficient detail and extent to provide for complete verification and evaluation of the operations and objectives. Records shall disclose status of articles and materials and evidence of inspections/tests performed, including the date(s).
- c. Records for each subsystem shall be updated as a means of documenting the continuing history. Each record shall be identifiable to the pertinent equipment and shall be maintained in chronological order to account for all fabrication, assembly, and test operations, as well as idle periods (storage) and movements of equipment. Entries shall be complete, self-explanatory, traceable to the individual and organization making entry, and should include or refer to details of cumulative operating time/cycles. These records shall become a part of the equipment data package.
- d. Storage areas (contractor and NASA controlled) shall provide for positive identification of limited life material and removal of materials when shelf life has expired.
- e. A system of records of age control and limited life products is maintained. The records shall be updated when life or cycle use occurs. The records shall exhibit evidence of the beginning of useful age, life, or cycle(s) and the date, test time or cycle(s) at which the limit shall be expended.